06 ELECTRICAL SYSTEM

Table of Contents

06.00 GENERAL

Wiring

For the **STEYR Marine Engines** wiring and plug connections have been defined according to standard DIN 72 552.

In case of necessary repair of a cable connection, take special care that cable quality, isolation, crimping, strand end soldering of cable sockets as well as protective varnish isolation and/or connector locks meet the respective requirements.

Tools for crimp connections to be found in tool catalog P/N Z001002/0 "Level 4".

06.00.01 Cable numbers / principal functions:

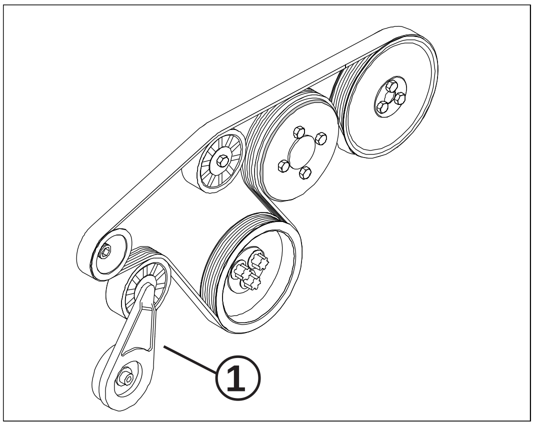
Cable number	Function
15000-xx	ignition - positive (from ignition switch)
15012-xx	+12 volt via main relay and control unit A5
15100-xx	+5 volt supply voltage for sensors
30000-xx	battery-positive (not secured)
30012-xx	battery-positive (secured)
31000-xx	battery-negative (GND)
31100-xx	Do not connect earth for sensors with battery-negative!
601xx-01	Sensor signal to control unit A5 and/or instruments.
606xx-01	Output from control unit A5 to display system (tachometer, temperature display, ...)

06.01 ALTERNATOR

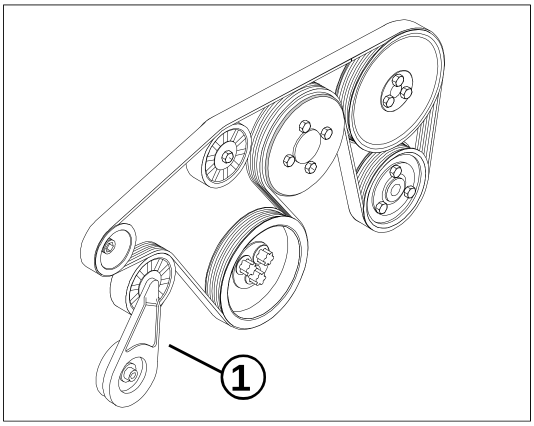
06.01.01 Adjust poly-V-belt tension

◐ **For 4 cyl. engines only**

Automatic initial tension of belt tension through spring-loaded tightener. (ill.1 and ill.2)



01.01 ill.1



01.01 ill.2

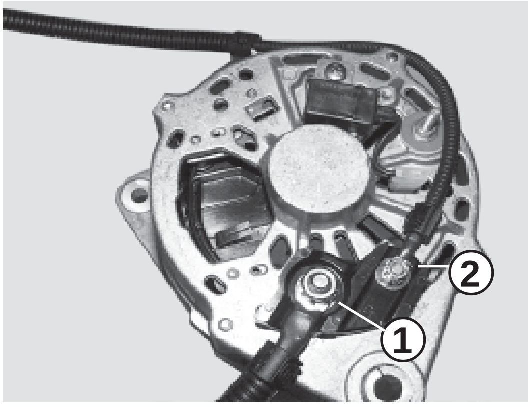
For 6 cyl. engines only

As to tension of V-belt for alternator, refer to chapter 05.07.01 - 02

06.01.02 Replace alternator

Preparatory work: turn off engine, disconnect battery

1 Disconnect two cables (ill. 1/pos.1+2).

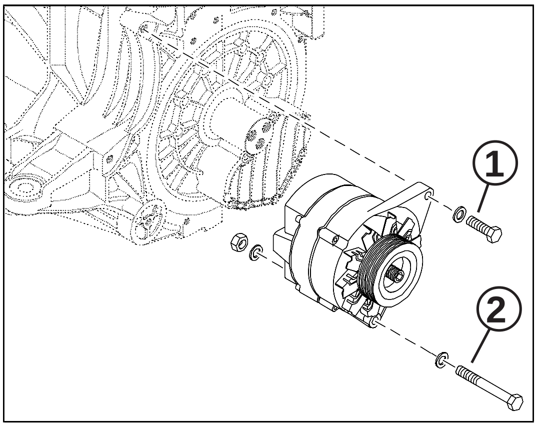


01.02 ill.1

2 Remove belt.

3 Loosen screws (ill.2/pos.1+2), remove alternator.

NOTE: Assembly is done in reverse order.

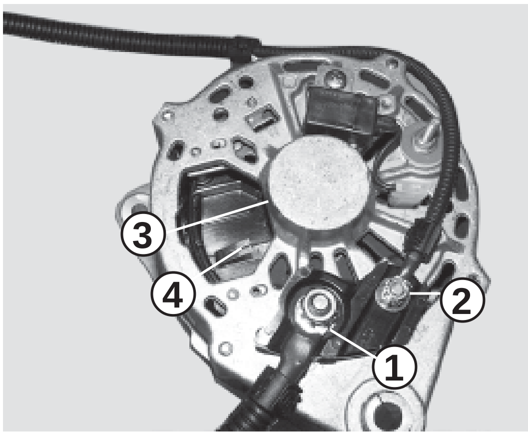


01.02 ill.2

◐ **For 4 cyl. engines only**

Connections acc. illustration 3:

ill.3/1	B+	battery
ill.3/2	D+	charging control (L1)
ill.3/3	DF	D-field (rotor winding)
ill.3/4	D+	on governor

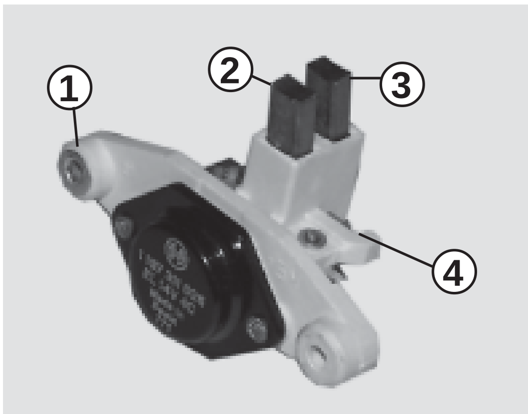


01.02 ill.3

◐ **For 4 cyl engines only**

Governor acc. illustration 4:

ill.4/1	B-
ill.4/2	DF
ill.4/3	D+
ill.4/4	D+

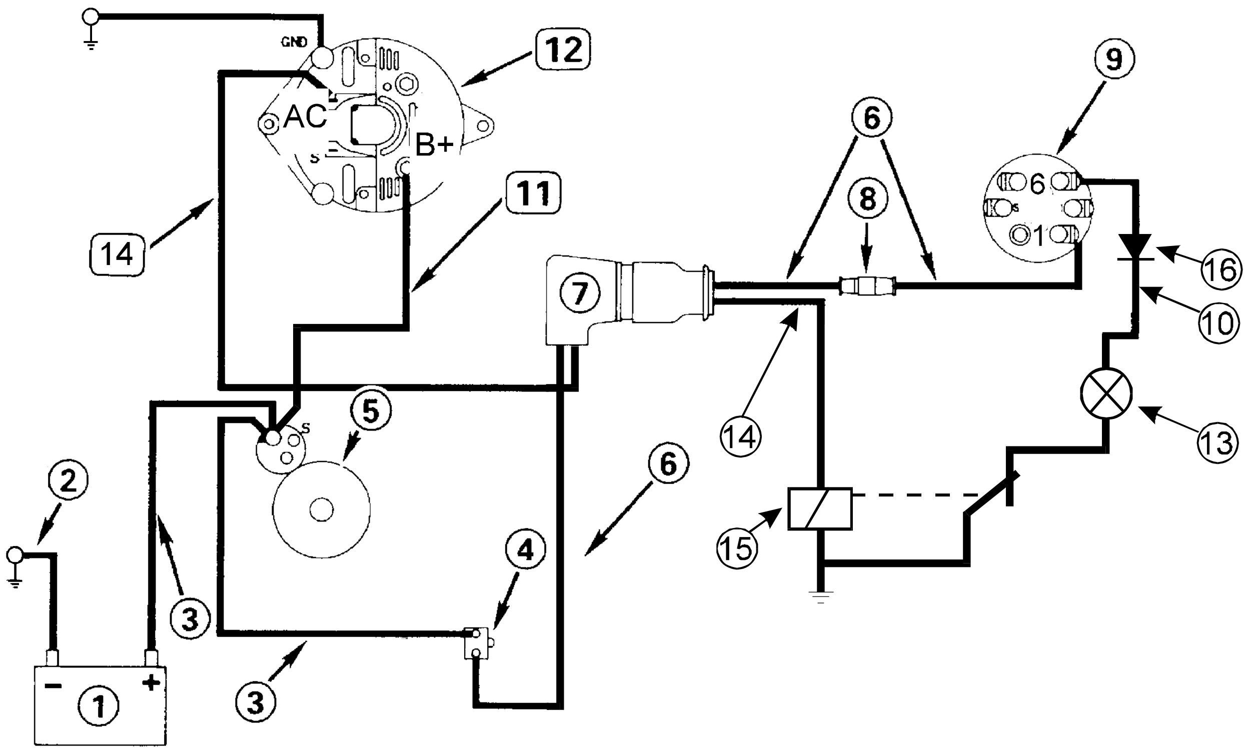


01.02 ill.4

06.01.03 Technical data of alternator

For 6 cyl. engines only (old version till eng. no. 68224418)

Model	PRESTOLITE LEECE-Neville 8RG2043
Minimum speed for voltage generation	580 1/min
Controlled voltage range	13,9 - 14,2 V
Output current	90 A
Governor	integrated base governor
Charge capacity	
at 750 r.p.m.	approx. 34 A
at 2500 r.p.m	maximum charge capacity
Condensor capacity	2,2 µF

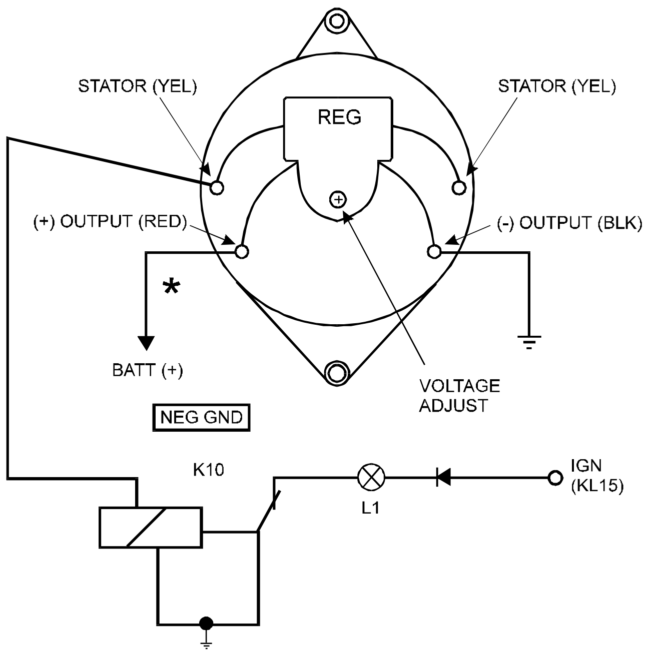


01.03 ill.1

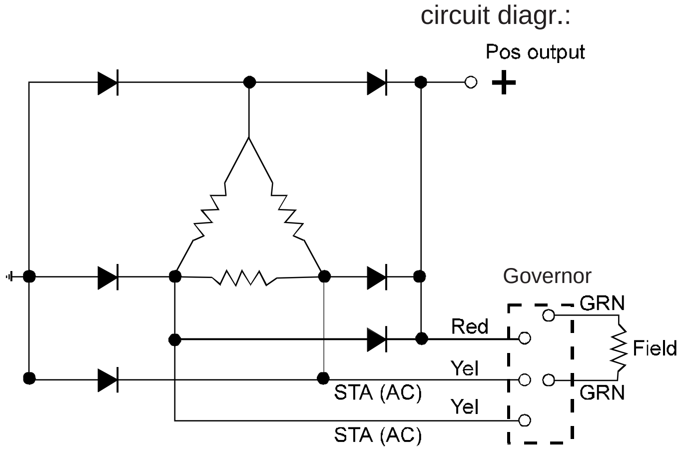
Charging circuit - scheme

1 ..... battery
2 ..... Z2, ground connection on engine
3 ..... red
4 ..... fuse 50 A
5 ..... starter engine
6 ..... red
7 ..... plug (engine electrics/instrument cable)
8 ..... fuse 10 A
9 ..... starter key lock
10 ..... 15000-xx
11 ..... red 16 mm²
12 ..... generator
13 ..... charging controll (L1)
14 ..... 61000-02 (18-pole connecting cable No.: 11)
15 ..... relay K10
16 ..... blocking diode (1N4007)

For 6 cyl. engines only (old version till eng. no. 68224418)



01.03 ill.2



01.03 ill.3

Check of alternator and connections:
With engine stopped, measure voltage on alternator (+output and -output).
Measured voltage may be lower than the battery voltage by (up to) 1 volt only.
Where appropriate, test wiring of cables and connections.

Check of control voltage and/or alternator voltage:

NOTE: For these works, the battery's state of charge should be 95% at least.
Check tension of belt on alternator drive and make sure that cables are perfectly connected.

1. Disconnect all electrical consuming devices and adjust engine to a speed of approx. 1000 rpm.
2. Connect voltmeter to alternator output "B +".
3. Remove plastic screw on governor and apply screw driver with fine blade on adjusting screw.

ATTENTION: The adjusting screw has a min./max. stop. There is danger to damage the governor when turning by force the adjusting screw so far that it overtravels the specified control range.

4. Turn screwdriver clockwise to increase the operating voltage and/or anticlockwise to lower the operating voltage. Adjust voltage range between 14,0 and 14,2 volt (28,0 to 28,4 volt for 24-volt plants).

ATTENTION: Do not turn adjusting screw so far that it overtravels the stop, to prevent damages to the governor.

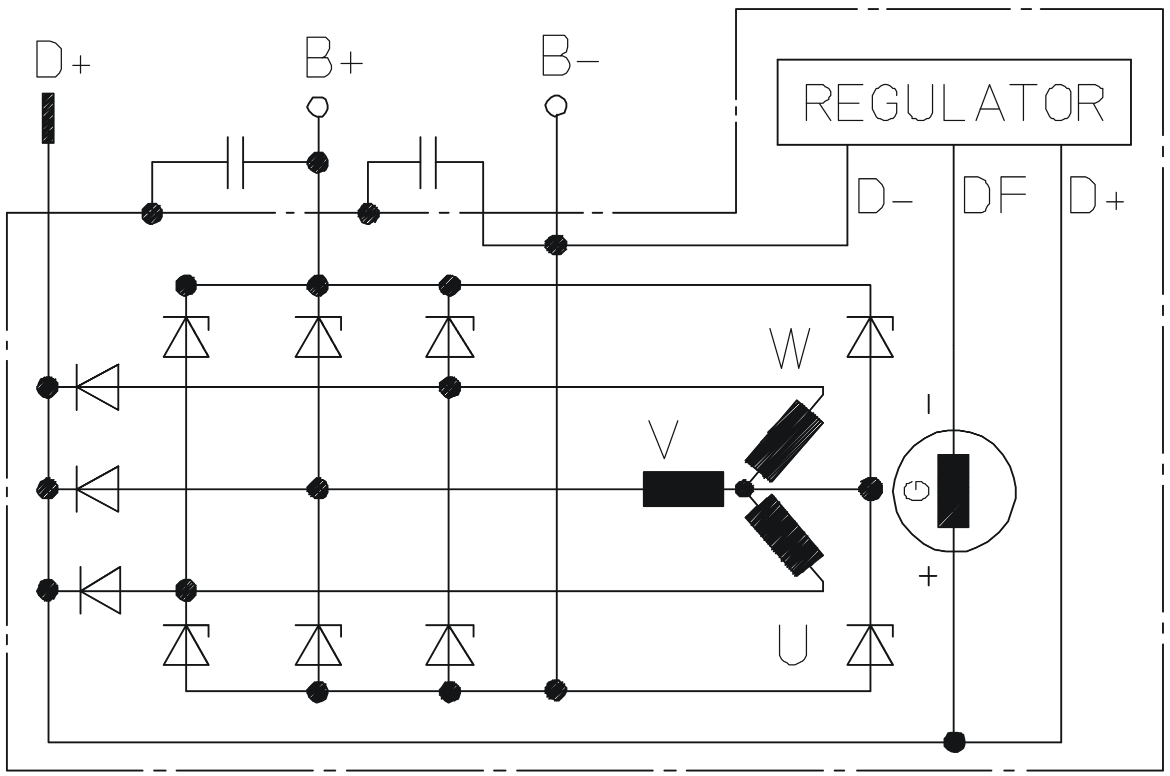
5. After adjustment, remove screwdriver and voltmeter and lock the governor by means of removed plastic screw.

If voltage cannot be set to specified value, replace governor and/or alternator.

Check of slip pistons:
Disconnect battery and/or main switch.
Unscrew governor. Clean slip ring and wipers; where appropriate, replace wipers.

For 6 cyl.engines / Technical data of alternator 14V / 90A (current version from eng. no. 68224419)

Model ISKRA-AAK5550-11.203.329
Minimum engine speed for voltage generation 550 1/min
Controlled voltage range .... 14,1 - 14,5 V
Output current .... 90 A
Governor .... integratedl base governor
Excitation winding resistance .... 2,7 / +0,27 Ω



01.03 ill.4

Error Detection

Check battery:
- All connections (terminals)
- Acid concentration
- Filling level (check, refill if necessary)
- Carry out load test

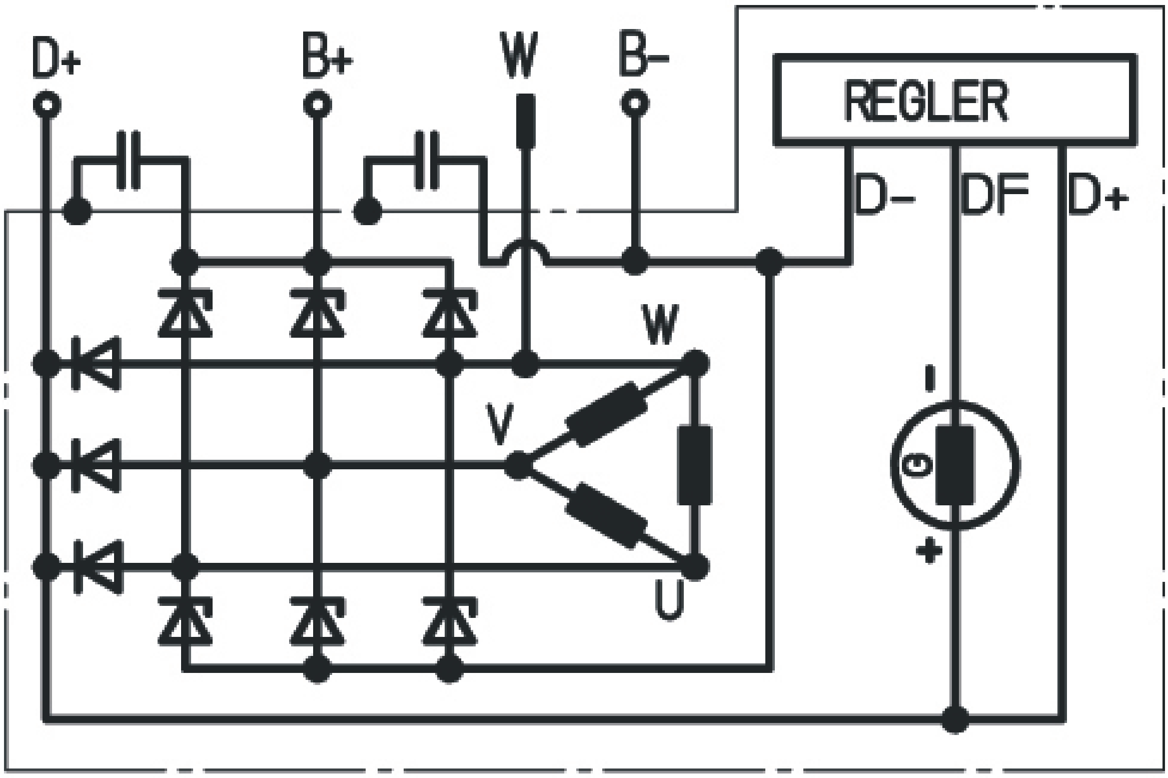
Excessive voltage:
- Governor
- Loose connections
- Battery

Charging voltage too low:
- Belt tension
- Output
- Governor
- Slip ring
- Internal components of alternator

No charging voltage:
- Belt tension
- Charging control lamp defective (12V/2W)
- Output
- Cables and connections
- Governor
- Slip ring
- Internal components of alternator

For 6 cyl. engines / Technical data of alternator 28V / 80A (Option)

Model ISKRA-AAN5161-11.203.220
Minimum engine speed for voltage generation 550 1/min
Controlled voltage range .... 28,1 - 28,7 V
Output current .... 80 A
Governor .... integratedl base governor
Excitation winding resistance .... 7,9 / +0,79 Ω



01.03 ill.5

Error Detection

Check battery:
- All connections (terminals)
- Acid concentration
- Filling level (check, refill if necessary)
- Carry out load test

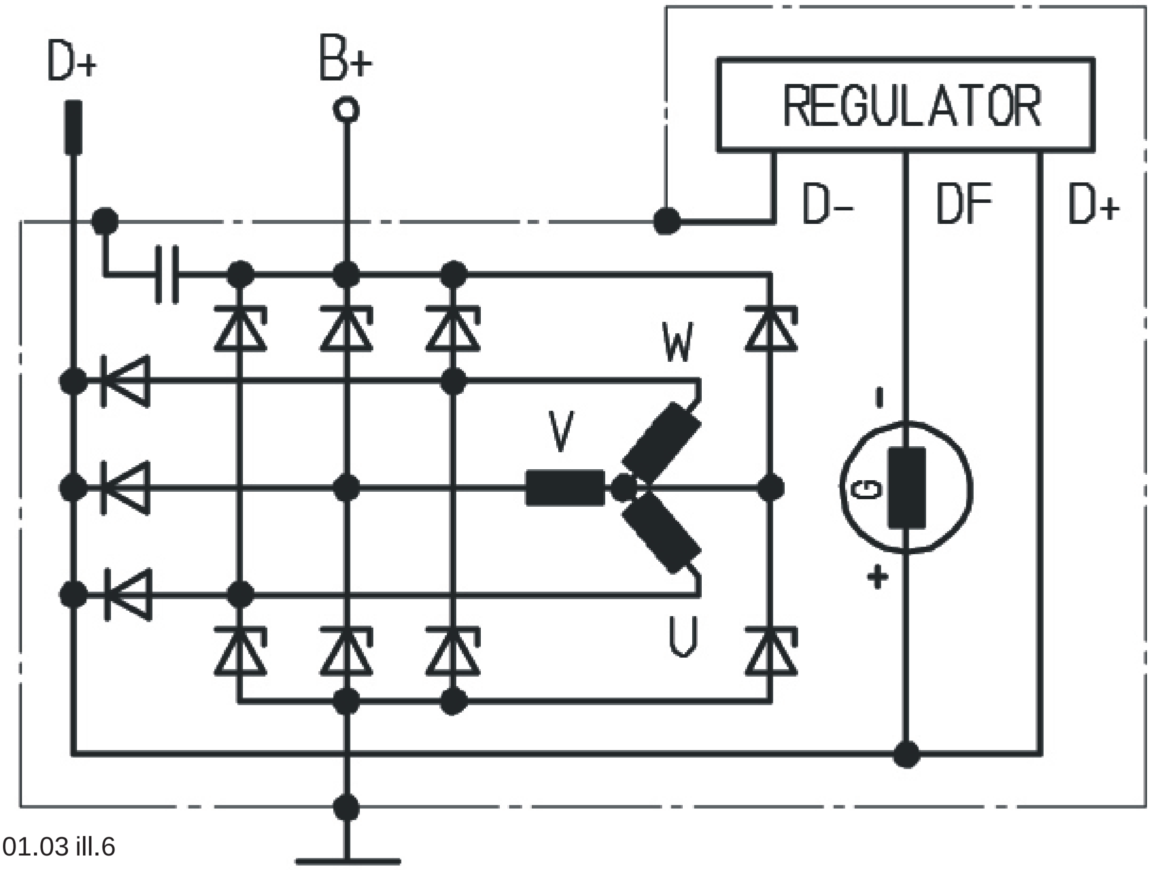
Excessive voltage:
- Governor
- Loose connections
- Battery

Charging voltage too low:
- Belt tension
- Output
- Governor
- Slip ring
- Internal components of alternator

No charging voltage:
- Belt tension
- Charging control lamp defective (24V/3W)
- Output
- Cables and connections
- Governor
- Slip ring
- Internal components of alternator

For 6 cyl. engines / Technical data of alternator 28V / 55A (Option)

Model ISKRA-AAK5170-11.201.894
Minimum engine speed for voltage generation 550 1/min
Controlled voltage range .... 28,0 - 28,4 V
Output current .... 55 A
Governor .... integratedl base governor
Excitation winding resistance .... 7,9 / +0,79 Ω



01.03 ill.6

Error Detection

Check battery:
- All connections (terminals)
- Acid concentration
- Filling level (check, refill if necessary)
- Carry out load test

Excessive voltage:
- Governor
- Loose connections
- Battery

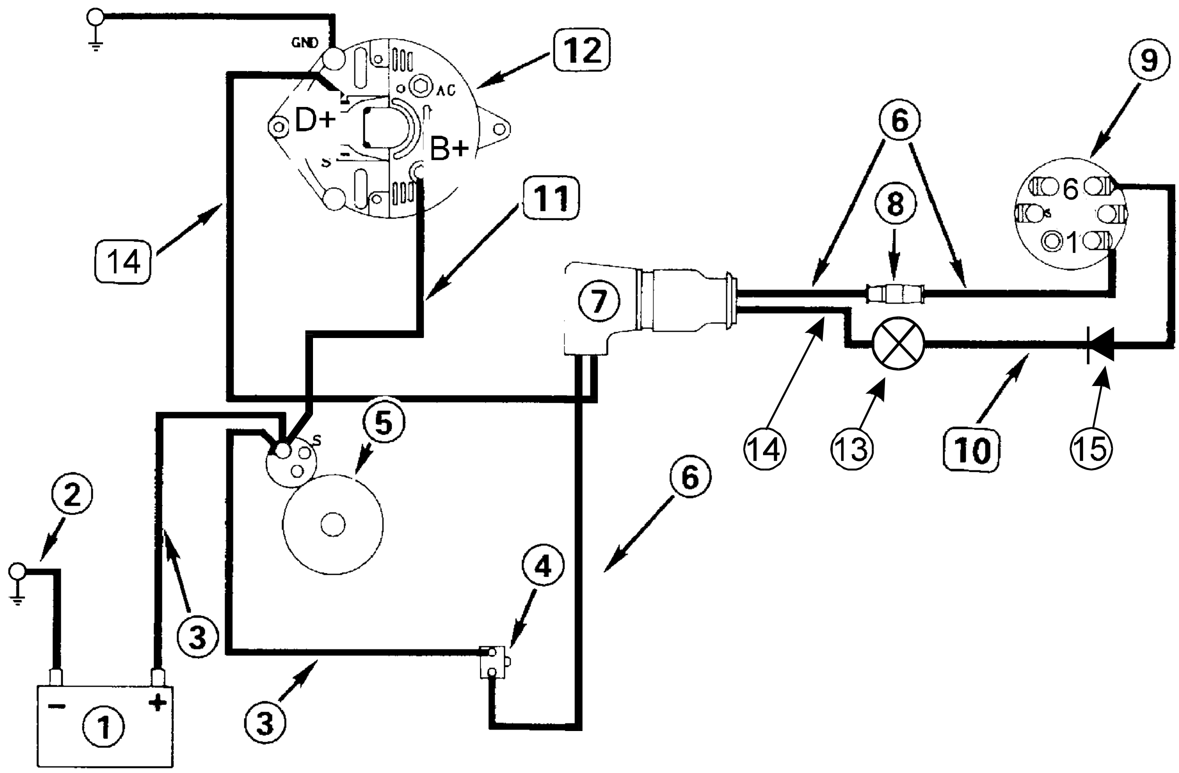
Charging voltage too low:
- Belt tension
- Output
- Governor
- Slip ring
- Internal components of alternator

No charging voltage:
- Belt tension
- Charging control lamp defective (24V/3W)
- Output
- Cables and connections
- Governor
- Slip ring
- Internal components of alternator

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◐ **For 4 cyl. engines only / Technical data of alternator**

Model .... BOSCH No. 6 033GB3 046
Minimum speed for voltage generation 550 1/min
Controlled voltage range .... 13,9 - 14,7 V
Output current .... 90 A
Governor .... integratedl base governor
Charge capacity
at 750 r.p.m. .... ca. 34 A
at 3000 r.p.m. .... maximum charge capacity
Condensor capacity .... 2,2 µF



01.03 ill.7

Charging circuit - scheme

1 ...... battery
2 ..... Z2, ground connection on engine
3 ..... red
4 ..... fuse 50 A
5 ..... starter engine
6 ..... red
7 ..... plug (engine electrics/instrument cable)
8 ..... fuse 10 A
9 ..... starter key lock
10 ..... 15000-xx
11 ..... red 16 mm²
12 ..... generator
13 ..... charging control (L1)
14 ..... 61000-02 (18-pole connecting cable Nr.: 11)
15 ..... blocking diode (1N4007)

◐ **For 4 cyl. engines only**

Error Detection

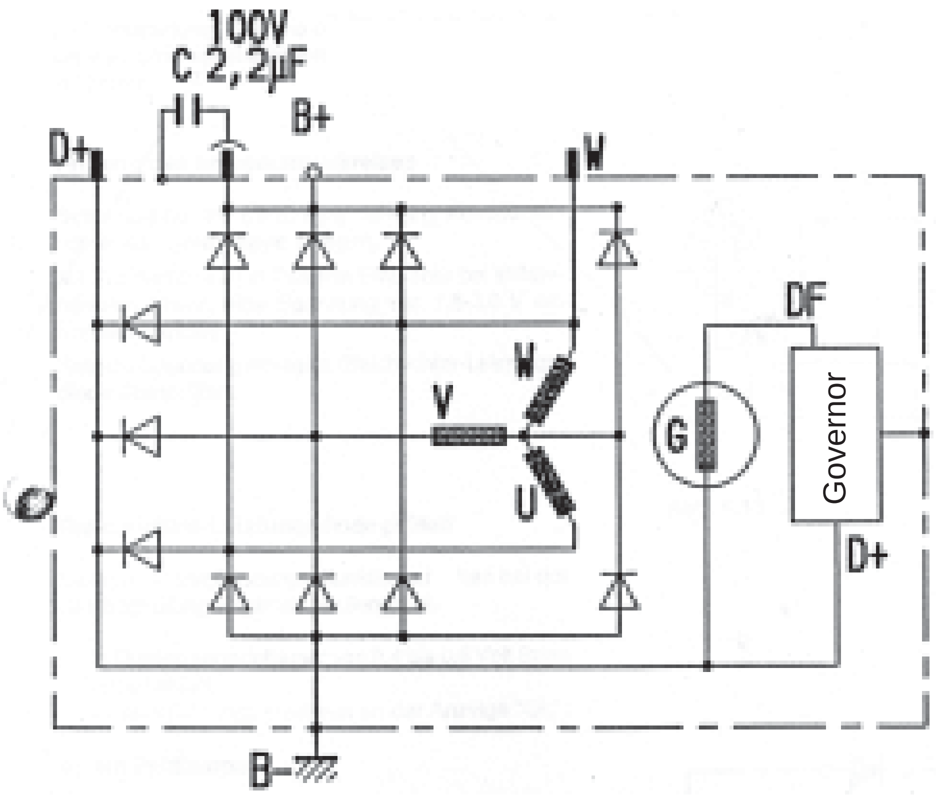
Check battery:
- All connections (terminals)
- Acid concentration
- Filling level (check, refill if necessary)
- Carry out load test

Excessive voltage:
- Governor
- Loose connections
- Battery

Charging voltage too low:
- Belt tension
- Output
- Governor
- Slip ring
- Internal components of alternator

No charging voltage:
- Belt tension
- Charging control lamp defective (12V/2W)
- Output
- Cables and connections
- Governor
- Slip ring
- Internal components of alternator

Alternator - scheme



01.03 ill.8

06.01.04 Check alternator (error detection for BOSCH alternator, 4 cyl. engines)

Trouble features	Test procedure	Error and/or Relief
With engine stopped and ignition on, generator control lamp (L1) not shining or only slightly.	Tester lamp connected between B+ and D+ on generator ; shining brightly.	Generator control lamp (L1) burned out and/or disconnection in electric circuit of generator control lamp (L1) between term. 15 (No. 15000-xx) and term. D+ (No. 61000-02) on generator.
	Tester lamp connected between B+ and D+ on generator ; not shining, but shining brightly when connected between D+ and ground. Generator control lamp (L1) does not shine in both cases.	Short circuit of a positive diode. Immediately disconnect starter battery from generator, otherwise battery may be discharged on state -> replace generator.
	Tester lamp connected between D+ and ground; tester lamp and generator control lamp (L1) glowing.	Error, wipers of governor worn out, oxid film on slip rings, disconnection of rotor winding -> replace governor and/or generator.
With both engine stopped and running, generator lamp (L1) constantly shines brightly.	With engine stopped, disassemble attached governor.	
	Generator control lamp (L1) still shining brightly.	Earth short circuit in lead betweeen generator control lamp and terminal D+ on generator.
	Generator control lamp (L1) extinguishes. Install governor again. Connect ammeter between B+ and D+ (on generator). Exciting current is lower than specified (4 amp +/- 0,4). Exciting current is higher than specified (4 amp +/- 0,4).	Governor is defective -> replace governor. Earth short circuit in the field of governor and connection DF (see ill.) of generator, earth short circuit in rotor winding -> replace generator.
With engine stopped, generator control lamp (L1) shines brightly, with engine running only shines slightly.	Connect tester lamp between B+ and D+ of generator. With engine running, tester lamp extinguishes. With engine running, tester lamp glows. With engine stopped, install new governor and start engine again. Tester lamp between B+ und D+ Tester lamp extinguishes Tester lamp still glows	Contact resistance in charging circuit or in conductor to generator control lamp (L1) Governor or generator defective. Disassembled governor was defective. Generator is defective -> replace.

Check rectifier diode

Measuring devices with diode test function will show the following results:

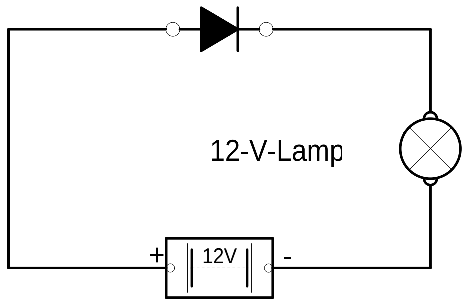
- in forward direction: voltage drop from 0.4 to 0.6 volt
- in backward direction: reading is "OL".

a) by means of control lamp

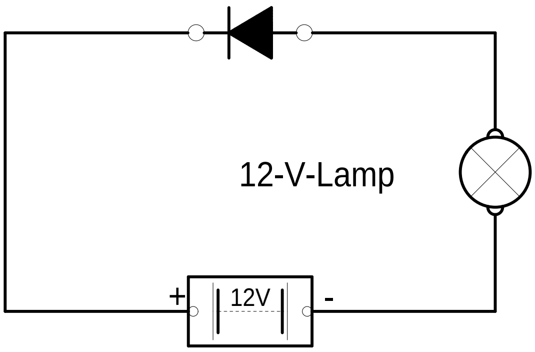
Diode and control lamp are connected in series in both forward and backward direction in an electric circuit. Diodes permitting passage in both directions were mostly exposed to excessive voltages. On the other hand, diodes with an interruption in forward direction were mostly destroyed by excessive current or excessive heating.

ill. 04.1 Lamp burning: diode functional.
Lamp not burning: diode interrupted.

ill. 04.2 Lamp not burning: diode functional,
Lamp burning: diode had short circuit.



01.04 ill.1



01.04 ill.2

b) by means of ohmmeter

For diode testing, only a simple, battery-powered ohmmeter may be used.
Measuring bridges are unsuitable, as they indicate wrong values. Under no circumstances, hand generators may be used. Their high voltage would destroy the diodes. A perfect diode shows a resistance of only a few ohms (0,5 ...10 Ohm) in forward direction, but several kiloohms (almost) in backward direction.

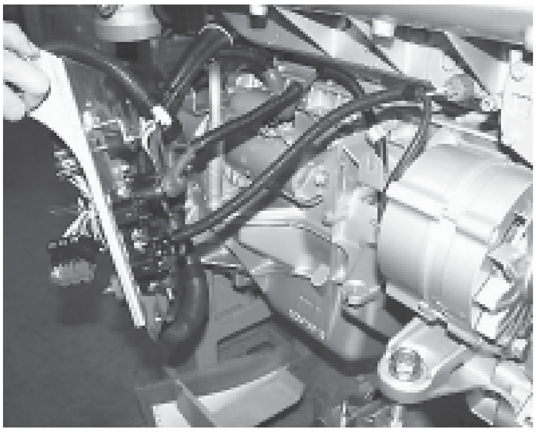
06.03 REPLACE STARTER MOTOR

1 Disconnect battery.

2 Remove cover of E-box. Remove E-box.

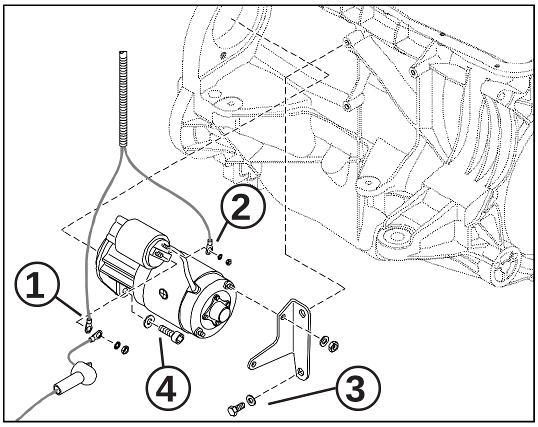
3 Loosen terminal +30 (ill.2/pos.1) on magnetic switch by means of (SW13).

4 Loosen start signal wiring (terminal 50) (ill.2/pos.2) by means of (SW10).



03.00 ill.1

5 Loosen two hexagon screws (ill.2/pos.3) (SW13) of starter bracket.



03.00 ill.2

6 Loosen two screws (SW8) (ill.2/pos.4), remove starter.

NOTE: Have starter motor repaired in an authorized STEYR workshop.

After assembly, coat all electric supplies with rubber sealing Z909570/0.

06.03.01 Check starter

Trouble features	Cause	Relief
When switching on the starter (acutation of starter key), starter shaft not turning or only slowly; starter pinion not engaging	battery discharged and/or defective	charge battery and/or replace
	terminals of starter battery are loose and/or oxidized, bad ground connection	clean terminals and tighten, treat with pole grease, provide ground connection
	earth short circuit of terminals of starter or carbon brushes	eliminate earth short circuit
	carbon brushes not resting on collector (sticking in guide, are broken, oily or worn out)	depending on failure, make work carbon brushes, clean or replace --> in case of very strong wear, replace various parts and/or starter
	starter key or starter relay K28 and/or actuating relay on starter defective	replace starter key or relay
	voltage drop in lines too large, lines damaged, line connections loose, links oxidized	check starter line, eventually replace, clean links and tighten
starter keeps on running after starter key was released	starter does not interrupt; starter key, starter relay (K28), actuating relay (on starter) defective short-circuit in wiring (cable No.: 50000-xx connected to +12V)	immediately turn off ignition, immediately disconnect battery; check key and/or relay, evenutally replace; check wiring in case of longer running time --> replace starter

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06.05 CABLES, WIRING HARNESS - GENERAL

Cable / wiring

In case of necessary repair of a cable connection, take special care that cable quality, isolation, crimping, strand end soldering of cable sockets as well as protective varnish isolation and/or connector locks meet the respective requirements.

Tools for crimp connections to be found in tool catalog P/N Z001002/0 "KIT 3".

06. 05. 01. Battery cable lengths and cross-sections

Determine the lenght of the positive cable from the positive pole (+) of the battery to connection No. 30 at the starter.

Total lenght is the sum of cable length of positive cable (+) and earth cable (-).

For example:

positive cable = 3,0 m
ground cable = 2,0 m

Total length = 5,0 m ===> cable cross section = 70 mm²

For ground connection, determine corresponding cross-sections as per chart.

◐ **For 4 cyl. engines only**

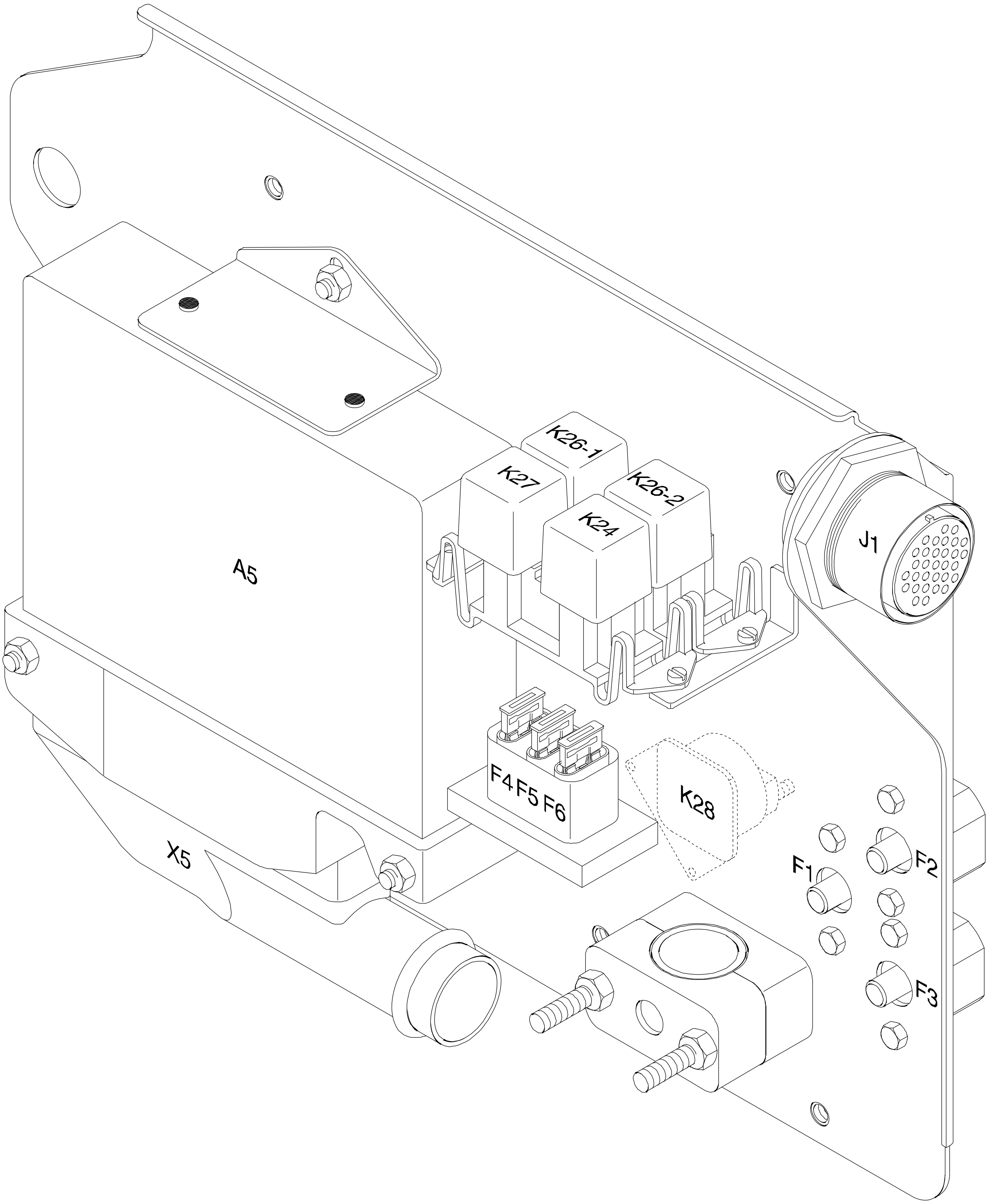
starter engine: 2 kW - 12 volt battery size: 92 AH		
length in m	cable cross-section in mm²	AWG
0,0 - 4,0 4,1 - 5,0 5,1 - 6,0	50 70 95	0 00 0000

◑ **For 6 cyl. engines only**

starter engine: 3 kW - 12 Volt battery size: 110 AH		
length in m	cable cross-section in mm²	AWG
0,0 - 3,0 3,1 - 4,5 4,6 - 5,5	50 70 95	0 00 0000

In general, take care that battery cable lengths are kept as short as possible.

06.05.02 E - box base plate; to eng.no.: 482 17 000

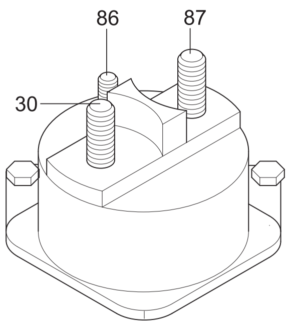


05.02 ill.1

06.05.02.01 Components of E - box; to eng.no.: 482 17 000

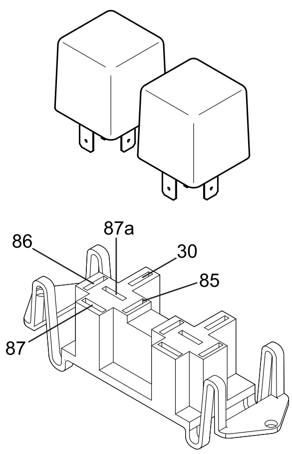
Designat.	Component	Description
A5	E - box	control unit
F1	fuse 50 A	main fuse
F2	fuse 50 A	glow plugs
F3	fuse 50 A	glow plugs
F4	fuse 5 A	permanent current module
F5	fuse 10 A	switched current for module (K27)
F6	fuse 10 A	fuel pump (K24)
J1	plug 23-pole	connection engine cable - instrument cable
K24	relay	fuel pump
K26-1	relay	preheating
K26-2	realy	preheating
K27	relay	main circuit
K28	relay	start assist relay
X5	plug 35-pole	module

06.05.02.02 Connection start assist relay K28



05.02 ill.2

06.05.02.03 Connection relay socket for K24, K26-1, K26-2 and K27



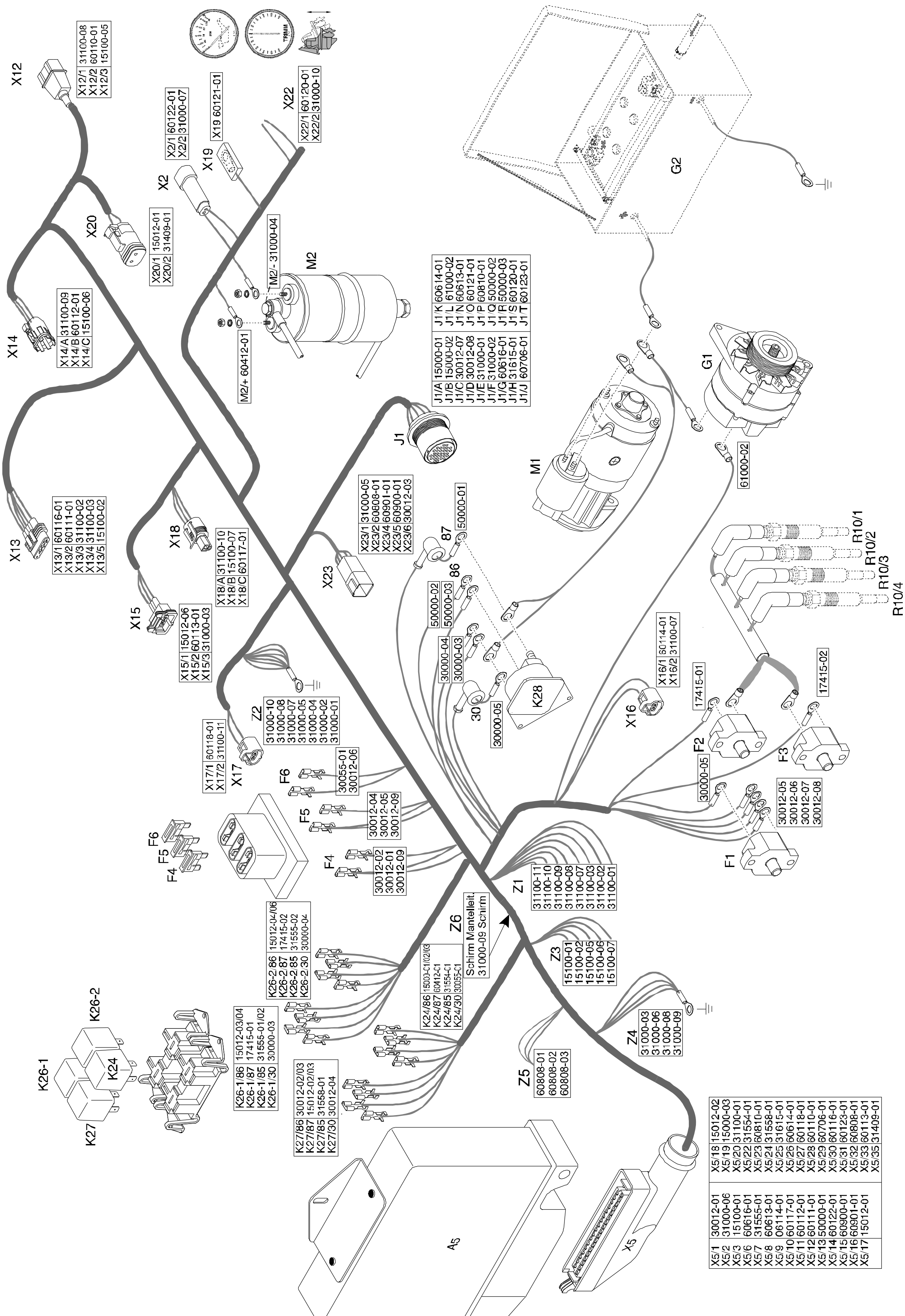
05.02 ill.3

06.05.02.04 Wiring harness; to eng.no.: 482 17 000

Designation	Component	Description
A5	E-box	control unit
F1	fuse 50 A	main fuse
F2	fuse 50 A	glow plugs
F3	fuse 50 A	glow plugs
F4	fuse 5 A	permanent current modul and K27
F5	fuse 10 A	switched current for module (K27)
F6	fuse 10 A	fuel pump (K24)
G1	alternator	
G2	battery	to be provided by customer
J1	23-pole plug	connection engine cable - instrument cable
K24	relay	fuel pump
K26-1	relay	preheating - load circuit
K26-2	relay	preheating - load circuit
K27	relay	main circuit
K28	relay	start
M1	starter	
M2	fuel pump	
R10	glow pins	
X2 (S2)	2-pole plug	gear switch
X5 (A5)	35-pole plug	module
X12 (B12)	3-pole plug	boost-pressure sensor
X13 (B13)	5-pole plug	pot. accelerator
X14 (B14)	3-pole plug	pot. rack position
X15(B15)	3-pole plug	engine speed sensor
X16 B(16)	2-pole plug	engine temperature sensor
X17 (B17)	2-pole plug	exhaust gas temperature sensor
X18 (B18)	3-pole plug	oil pressure sensor
X19 (B19)	1-pole plug	oil pressure gauge (optional)
X20 (Y20)	2-pole plug	control solenoid
X22 (B22)	without stop	trim sensor (optional)
X23	6-pole plug	diagnosis
Z1	splice spot	earth connection sensor
Z2	splice spot	earth connection (31) on engine
Z3	splice spot	sensor supply +5V
Z4	splice spot	earth connection (31) on E-box plate

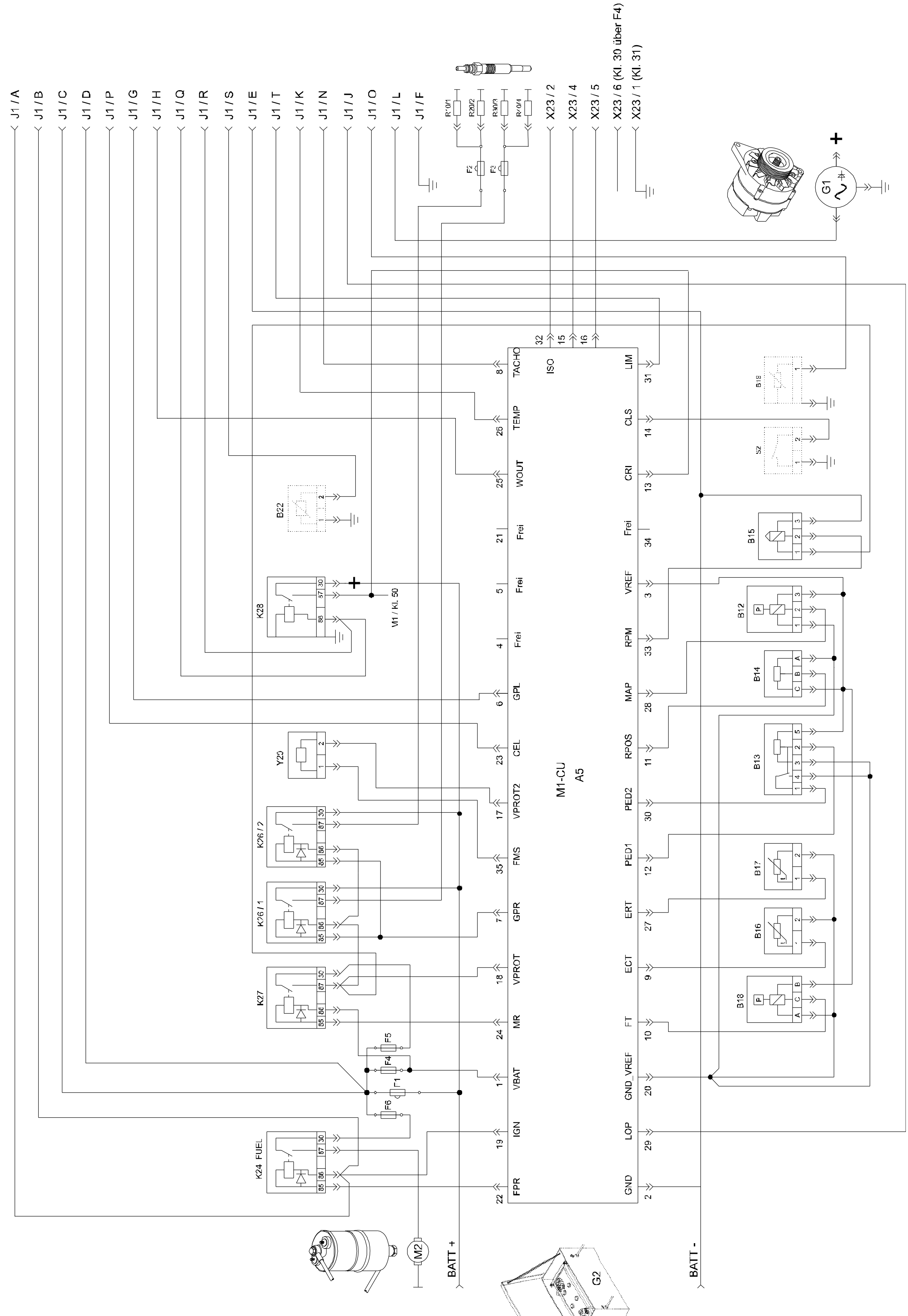
Cable numbers / principal functions:

15000-xx	ignition - positive (from ignition switch)
15012-xx	+12 volt via main relay and control unit A5
15100-xx	+5 volt supply voltage for sensors
30000-xx	battery-positive (not secured)
30012-xx	battery-positive (secured)
31000-xx	battery-negative (GND)
31100-xx	Do not connect earth for sensors with battery-negative!
601xx-01	Sensor signal to control unit A5 and/or instruments.
606xx-01	Output from control unit A5 to display system (tachometer, temperature display, ...)



05.02 ill.4

Wiring harness; to eng.no.: 482 17 000



Circuit diagram; to eng.no.: 482 17 000

05.02 ill.5

Line designations from - to
Wiring harness; to eng. no.:48 217 000

cable No.	designation from -->	pin No.	end point --> to	pin No.
15000-01	J1 plug engine / instruments	A	K24 relay fuel pump	86
15000-02	J1 plug engine / instruments	B	K24 relay fuel pump	86
15000-03	X5 control unit (A5)	19	K24 relay fuel pump	86
15012-01	X20 control solenoid(Y20)	1	X5 control unit (A5)	17
15012-02	X5 control unit (A5)	18	K27 main circuit relay	87
15012-03	K27 main circuit relay	87	K26/1 relay preheating	86
15012-04	K26/1 relay preheating	86	K26/2 relay preheating	86
15012-06	X15 speed sensor (B15)	C	K26/2 relay preheating	86
15100-01	X5 control unit (A5)	3	Z3 link (splice)	
15100-02	X13 pot. accelerator (B13)	5	Z3 link (splice)	
15100-05	X12 boost press. sensor(B12)	3	Z3 link (splice)	
15100-06	X14 pot. rack position (B14)	C	Z3 link (splice)	
15100-07	X18 oil pressure sensor (B18)	B	Z3 link (splice)	
17415-01	F2 50A fuse glow plugs	IN	K26/1 relay preheating	87
17415-02	F3 50A fuse glow plugs	IN	K26/2 relay preheating	87
30000-03	K26/1 relay preheating	30	K28 starter relay	30
30000-04	K26/2 relay preheating	30	K28 starter relay	30
30000-05	F1 50A main fuse	IN	starter solenoid	30
30012-01	X5 control unit (A5)	1	F4 fuse control unit	2
30012-02	K27 main circuit relay	86	F4 fuse control unit	2
30012-03	X23 diag	6	K27 main circuit relay	86
30012-04	K27 main circuit relay	30	F5 fuse control unit	2
30012-05	F1 50A main fuse	OUT	F5 fuse control unit	1
30012-06	F1 50A main fuse	OUT	F6 fuse fuel pump	1
30012-07	F1 50A main fuse	OUT	J1 plug engine / instruments	C
30012-08	F1 50A main fuse	OUT	J1 plug engine / instruments	D
30012-09	F5 fuse control unit	1	F4 fuse control unit	1

Line designations from - to
Wiring harness; to eng. no.:48 217 000

cable No.	designation from -->	pin No.	end point --> to	pin No.
30055-01	K24 relay fuel pump	30	F6 fuse fuel pump	2
31000-01	J1 plug engine / instruments	E	Z2 - mass point	
31000-02	J1 plug engine / insruments	F	Z2 - mass point	32
31000-03	Z4 earth connection in box		X15 speed sensor (B15)	3
31000-04	fuel pump (M2)	(M5)negat.	Z2 link (splice)	
31000-05	X23 diag	1	Z2 link (splice)	
31000-06	S4 earth connection in box		X5 control unit (A5)	2
31000-07	X2 gear switch(S2)	2	S2 link (splice)	
31000-08	S4 earth connection in box		Z2 earth connection engine	
31100-01	X5 control unit (A5)	20	Z1 link (splice)	
31100-02	X13 pot. accelerator (B13)	3	Z1 link (splice)	
31100-03	X13 pot. accelerator (B13)	4	Z1 link (splice)	
31100-07	X16 ECT (B16)	2	Z1 link (splice)	
31100-08	X12 MAP (B12)	2	Z1 link (splice)	
31100-09	X14 RACK (B14)	A	Z1 link (splice)	
31100-10	X18 oil pressure sensor (B18)	A	Z1 link (splice)	
31100-11	X17 sensor exh.gas temp.(B17)	2	Z1 link (splice)	
31409-01	X20 control solenoid (Y20)	2	X5 control unit (A5)	35
31554-01	K24 relay fuel pump	85	X5 control unit (A5)	22
31555-01	K26/1 relay preheating	85	X5 control unit (A5)	7
31555-02	K26/1 relay preheating	85	K26/2 relay preheating	86
31558-01	K27 main circuit relay	85	X5 control unit (A5)	24
31615-01	J1 plug engine / instruments	H	X5 control unit (A5)	6
50000-01	K28 starter relay	87	X5 control unit (A5)	13
50000-02	K28 starter relay	86	J1 plug engine / instruments	S
50000-03	K28 starter relay	Kl.86	J1 plug engine / instruments	T
60110-01	X12 MAP (B12)	1	X5 control unit (A5)	28

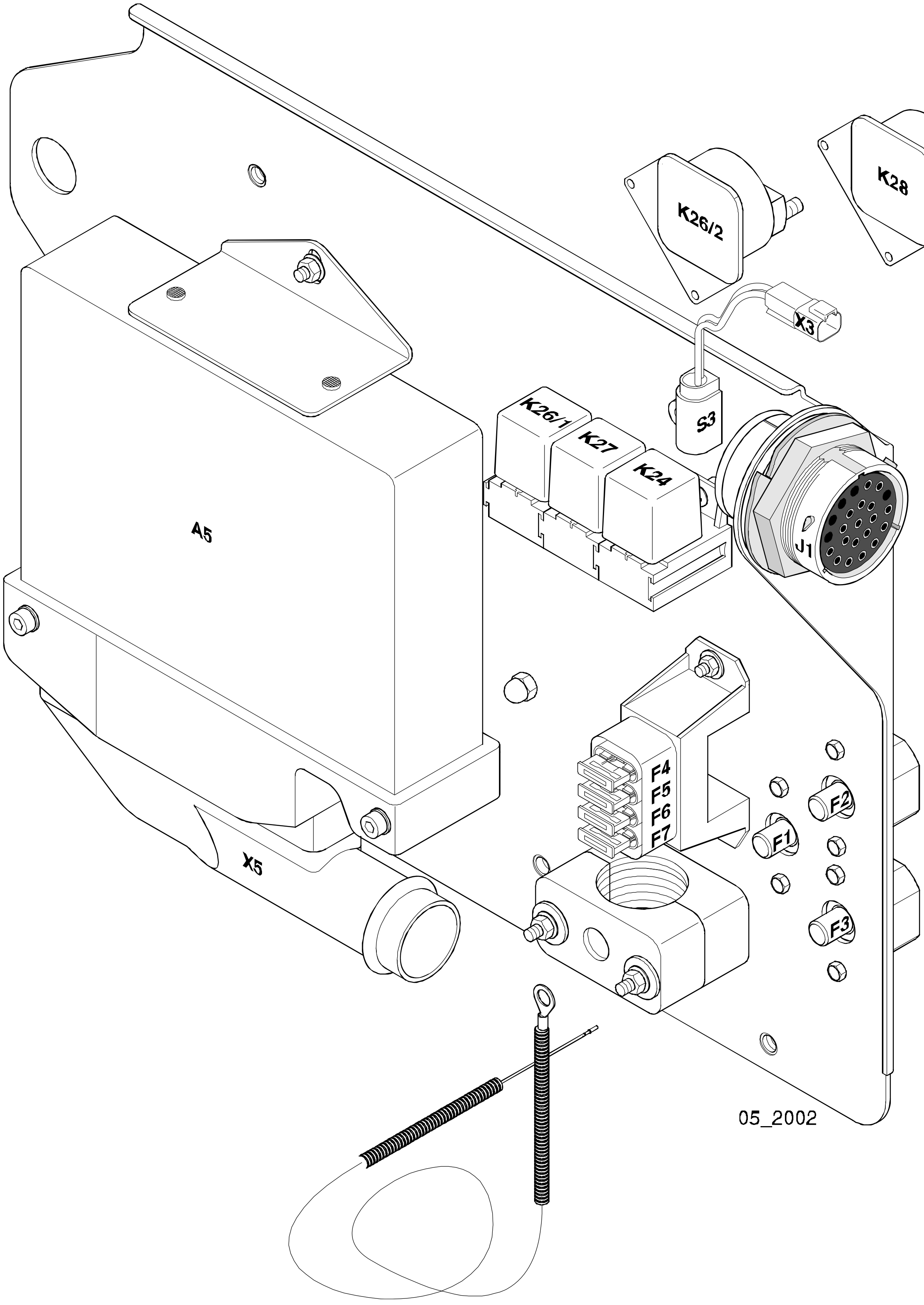
Line designations from - to
Wiring harness; to eng. no.:48 217 000

cable No.	designation from -->	pin No.	end point --> to	pin No.
60111-01	pot. accelerator B13	2	X5 control unit (A5)	12
60112-01	X14 RACK (B14)	B	X5 control unit (A5)	11
60113-01	X15 speed sensor (B15)	2	X5 control unit (A5)	33
60114-01	X16 ECT (B16)	1	X5 control unit (A5)	9
60116-01	X13 pot. accelerator (B13)	1	X5 control unit (A5)	30
60117-01	X18 oil pressure sensor (B18)	C	X5 control unit (A5)	10
60118-01	X17 sensor exh.gas temp.(B17)	1	X5 control unit (A5)	27
60121-01	J1 plug engine / instruments	P	oil pressure gauge	optional
60122-01	X2 gear switch(S2)	1	X5 control unit (A5)	14
60412-01	M2 fuel pump	(M4)posit.	K24 relay fuel pump	87
60613-01	J1 plug engine / instruments	N	X5 control unit (A5)	8
60614-01	J1 plug engine / instruments	K	X5 control unit (A5)	26
60616-01	J1 plug engine / instruments	G	X5 control unit (A5)	25
60706-01	J1 plug engine / instruments	J	X5 fixed rotation speed (A5)	29
60808-01	Z 5 60808		X5 control unit (A5)	32
60808-02	Z 5 60808		J1 plug engine / instruments	M
60808-03	Z 5 60808		X23 diag	2
60810-01	J1 plug engine / instruments	R	X5 control unit (A5)	23
60900-01	X23 diag	5	X5 control unit (A5)	15
60901-01	X23 diag	4	X5 control unit (A5)	16
61000-02	alternator D+	D+	J1 plug engine / instruments	L
network	shield	B15	S4 earth connection E-box	

Z 5 was only built up for wiring harnesses up to engine No. 48217020 (no function),

J1 / M on panel wiring harness „ free „.

06.05.03 E - box base plate; from eng. no.: 482 18 000 / 682 18 000 + SOLAS

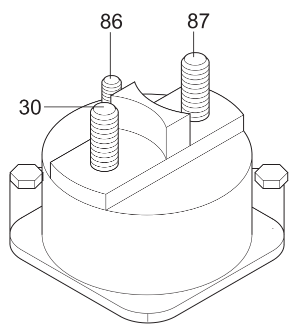


05.03 ill.1

06.05.03.01 Components of E-box; from eng. no.: 482 18 000 / 682 18 000 + SOLAS

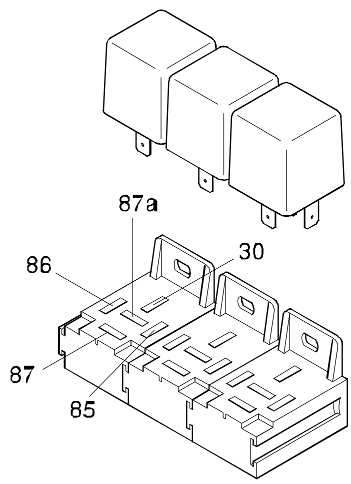
Designat.	Component	Description
A5	E - box	control unit
F1	fuse 50 A	main fuse
F2	fuse 50 A	glow plugs
F3	fuse 50 A	glow plugs
F4	fuse 5 A	permanent current module
F5	fuse 10 A	switched current for module (K27)
F6	fuse 10 A	fuel pump
J1	plug 23-pole	connection engine cable - instrument cable
K24	relay	fuel pump
K26-1	relay	preheating
K26-2	realy	preheating
K27	relay	main circuit
K28	relay	start
X3	plug 2-pole	inversion switch **(for SOLAS only)**
S3	inversion switch	**(for SOLAS only)**
X5	plug 35-pole	module

06.05.03.02 Connection relay K28 and K26/2



05.03 ill.2

06.05.03.03 Connection relay socket for K24, K26-1 and K27



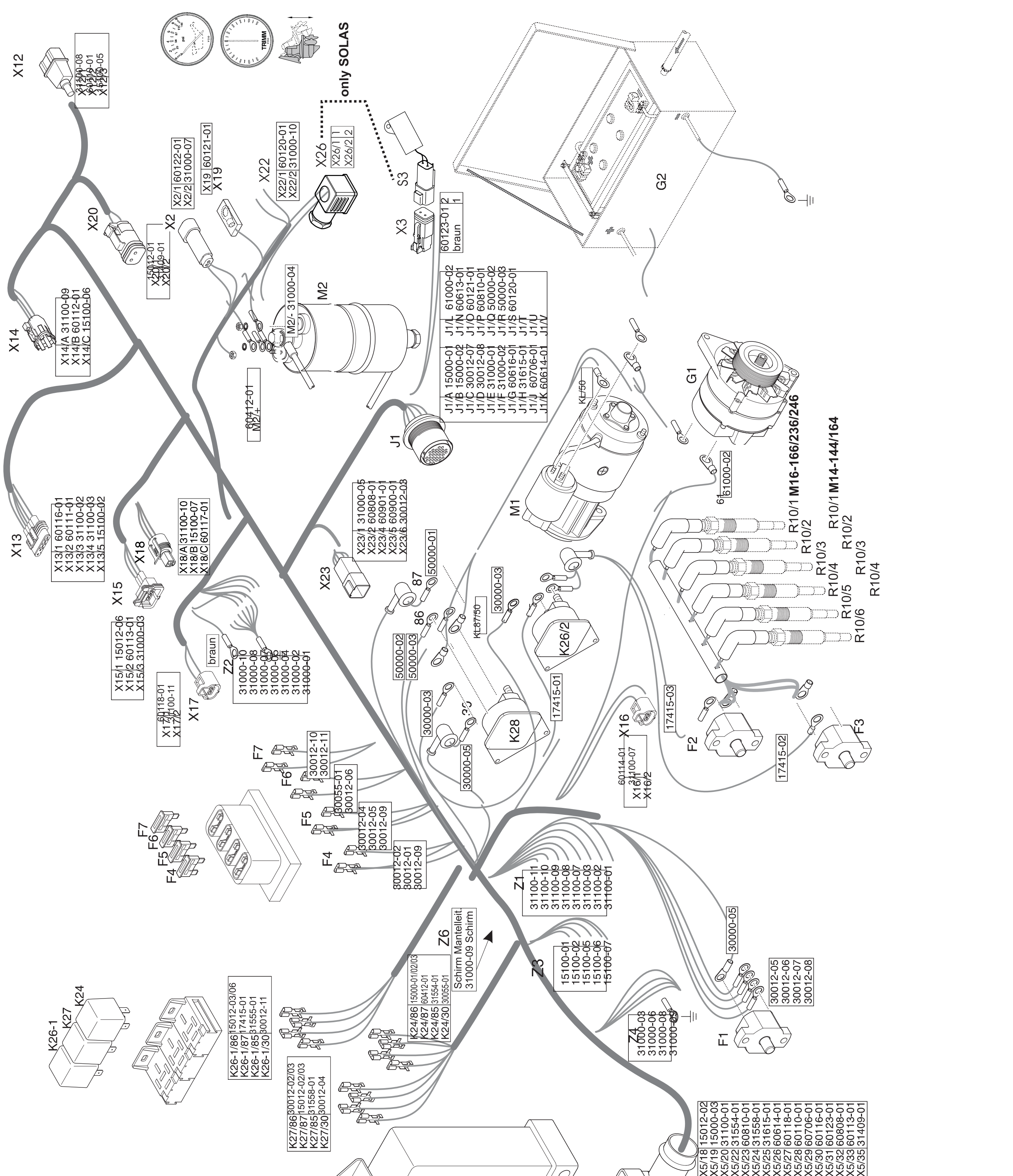
05.03 ill.3

06.05.03.04 Wiring harness; from eng.no.: 482 18 000 / 682 18 000 + SOLAS

Designation	Component	Description
A5	E-Box	control unit
F1	fuse 50 A	main fuse
F2	fuse 50 A	glow plugs
F3	fuse 50 A	glow plugs
F4	fuse 5 A	permanent current modul and K27
F5	fuse 10 A	switched current for module (K27)
F6	fuse 10 A	fuel pump (K24)
F7	fuse 10 A	preheating - control circuit
G1	alternator	
G2	battery	to be provided by customer
J1	plug 23--pole	connection engine cable - instrument cable
K24	relay	fuel pump
K26-1	relay	preheating - control circuit
K26-2	relay	preheating - load circuit
K27	relay	main circuit
K28	relay	start
M1	starter	
M2	fuel pump	
R10	glow pins	
X2 (S2)	plug 2-pole	gears switch
X3 (S3)	plug 2-pole	inversion switch **(only SOLAS)**
X5 (A5)	plug 35-pole	module
X12 (B12)	plug 3-pole	boost-pressure sensor
X13 (B13)	plug 5-pole	potentiometer accelerator
X14 (B14)	plug 3-pole	pot. rack position
X15(B15)	plug 3-pole	engine speed sensor
X16 B(16)	plug 2-pole	engine temperature sensor
X17 (B17)	plug 2-pole	exhaust gas temperature sensor
X18 (B18)	plug 3-pole	oil pressure sensor
X19 (B19)	plug 1-pole	oil pressure gauge (optional)
X20 (Y20)	plug 2-pole	control solenoid
X22 (B22)	without stop	trim sensor (optional)
X23	plug 6-pole	diagnosis
X26 (Y26)	plug 2-pole	disconnection blow-by **(only SOLAS)**
Z1	splice spot	earth connection sensor
Z2	splice spot	earth connection (31) on engine
Z3	splice spot	sensor supply +5V
Z4	splice spot	earth connection (31) on E-box plate
Z6	splice spot	shield speed sensor line

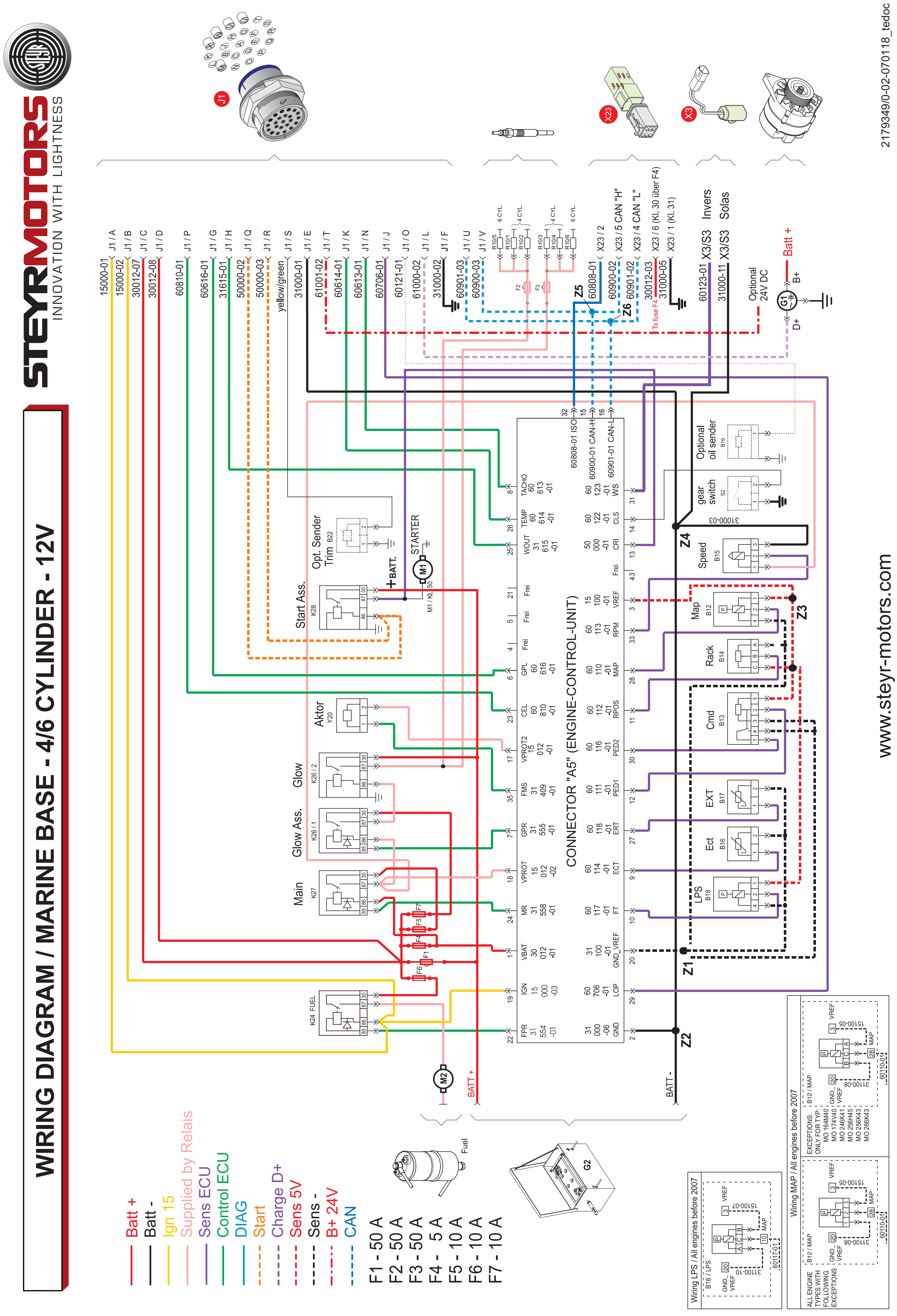
Cable numbers / principal functions:

15000-xx	ignition - positive (from ignition switch)
15012-xx	+12 volt via main relay and modulator unit A5
15100-xx	+5 volt supply voltage for sensors
30000-xx	battery-positive (not secured)
30012-xx	battery-positive (secured)
31000-xx	battery negative (GND)
31100-xx	Do not connect mass for sensors with battery negative!
601xx-01	Sensor signal to modulator unit A5 and/or instruments.
606xx-01	Exit from modulator unit A5 to display system (tachometer, temperature display, ...)

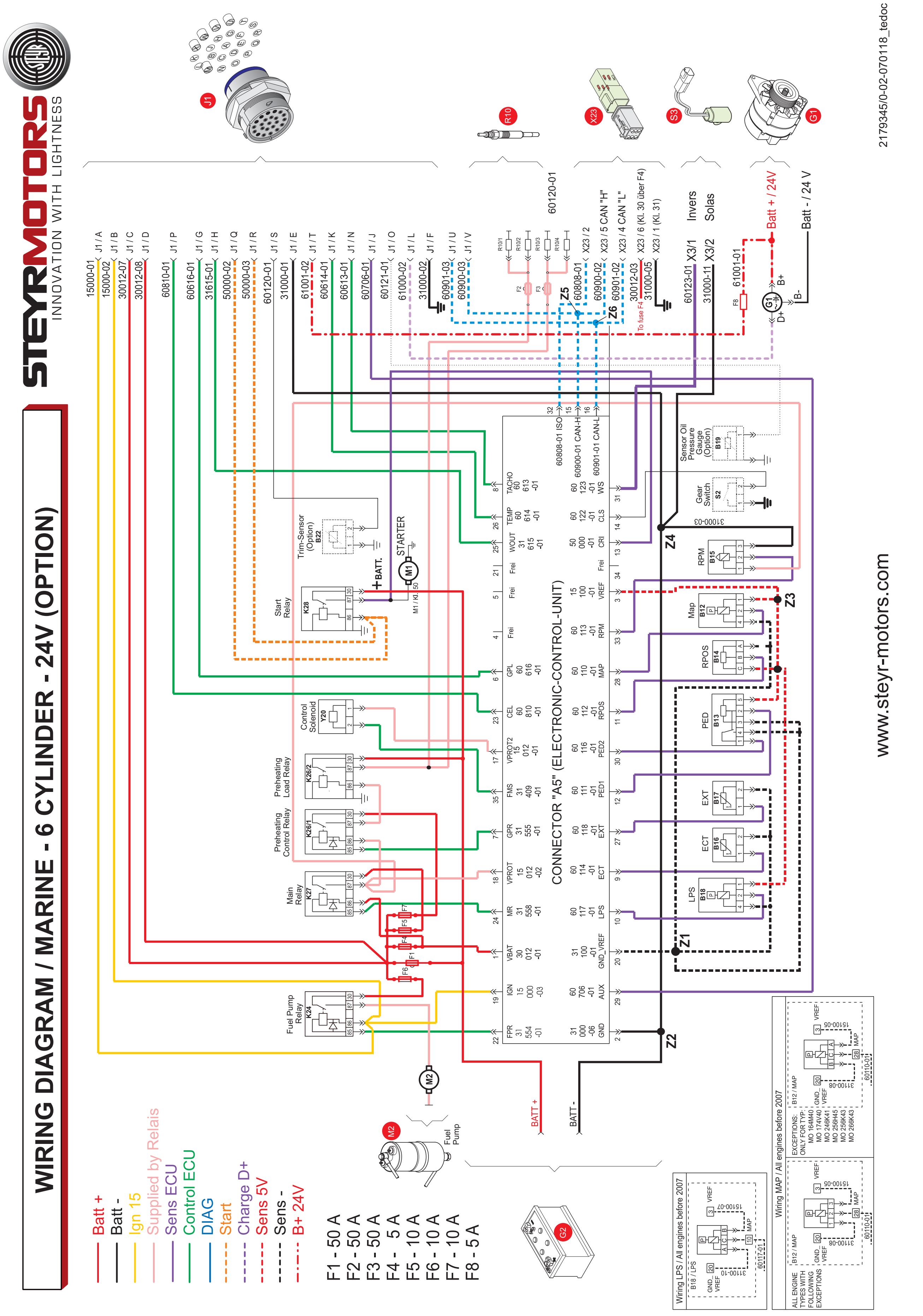


Wiring harness;
from eng.no.:
482 18 000 + SOLAS
682 18 000 + SOLAS

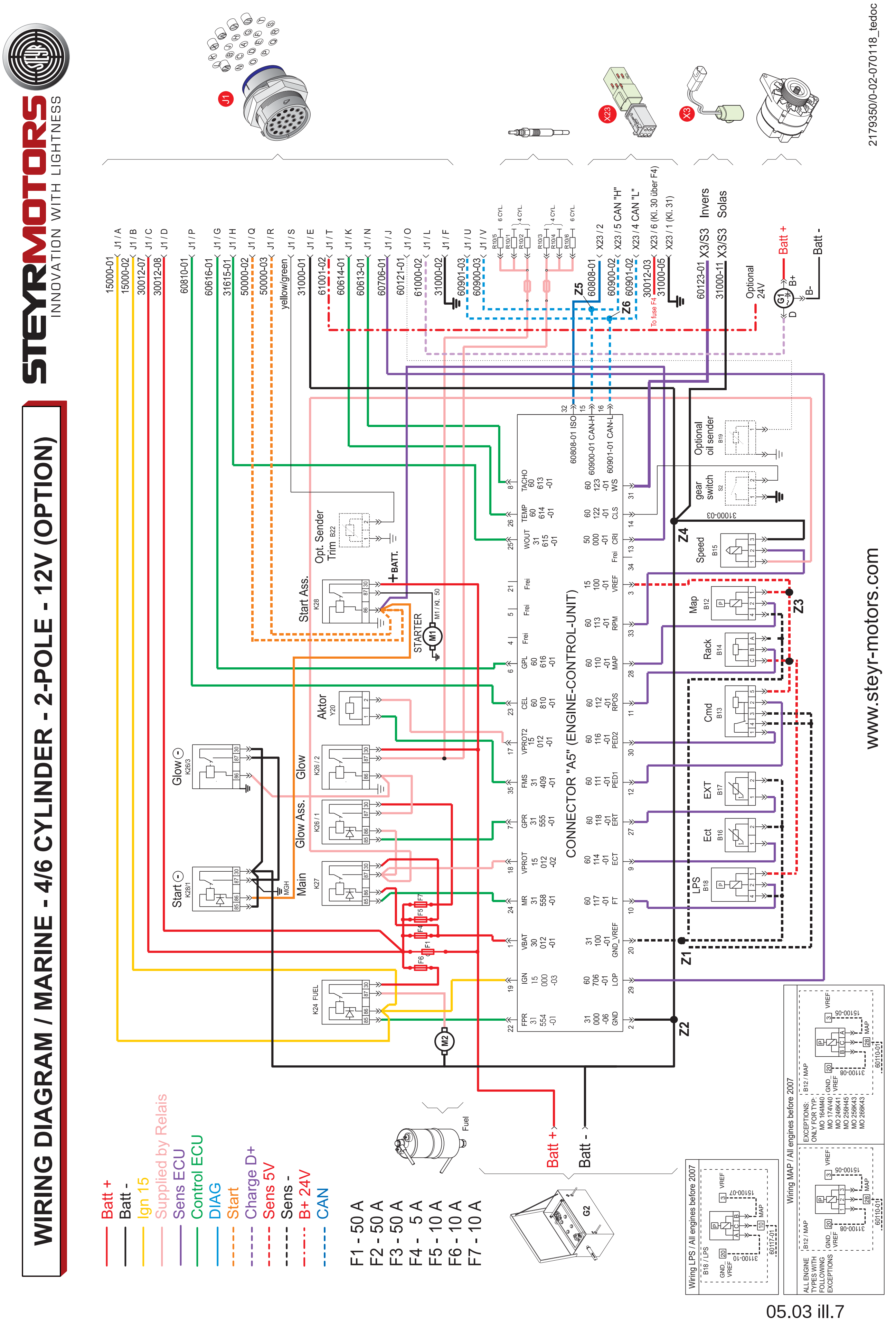
05.03 ill.4

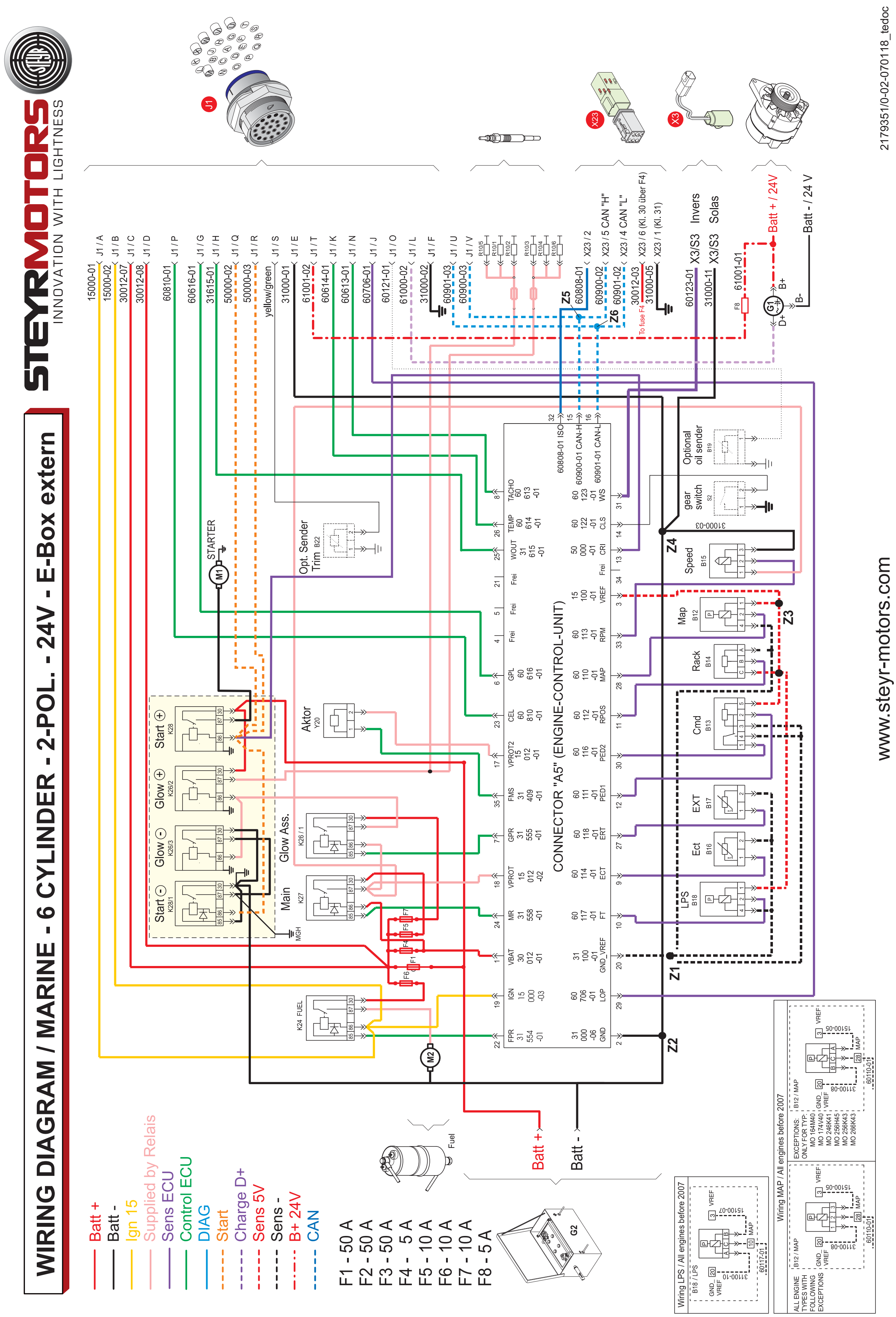

STEYRMOTORS
INNOVATION WITH LIGHTNESS
WIRING DIAGRAM / MARINE BASE - 4/6 CYLINDER - 12V
Batt +
Batt -
Ign 15
Supplied by Relais
Sens ECU
Control ECU
DIAG
Start
Charge D+
Sens 5V
Sens -
B+ 24V
CAN
F1 - 50 A
F2 - 50 A
F3 - 50 A
F4 - 5 A
F5 - 10 A
F6 - 10 A
F7 - 10 A
CONNECTOR "A5" (ENGINE-CONTROL-UNIT)
Main
Glow Ass.
Glow
Aktor
Start Ass.
Opt. Sender Trim
STARTER
BATT +
BATT -
Fuel
Speed
Map
Rack
Cmd
EXT
Ect
LPS
gear switch
Optional oil sender
Optional 24V DC
Batt +
Invers
Solas
Wiring LPS / All engines before 2007
Wiring MAP / All engines before 2007
2179349/0-02-070118_tedoc
www.steyr-motors.com

05.03 ill.5


WIRING DIAGRAM / MARINE - 6 CYLINDER - 24V (OPTION)
STEYRMOTORS
INNOVATION WITH LIGHTNESS
Batt +
Batt -
Ign 15
Supplied by Relais
Sens ECU
Control ECU
DIAG
Start
Charge D+
Sens 5V
Sens -
B+ 24V
F1 - 50 A
F2 - 50 A
F3 - 50 A
F4 - 5 A
F5 - 10 A
F6 - 10 A
F7 - 10 A
F8 - 5 A
CONNECTOR "A5" (ELECTRONIC-CONTROL-UNIT)
Fuel Pump Relay
Main Relay
Preheating Control Relay
Preheating Load Relay
Control Solenoid
Start Relay
Trim-Sensor (Option)
STARTER
Fuel Pump
BATT +
BATT -
Sensor Oil Pressure Gauge (Option)
Gear Switch
RPM
Map
RPOS
PED
EXT
ECT
LPS
Invers
Solas
Batt + / 24V
Batt - / 24 V
Wiring LPS / All engines before 2007
Wiring MAP / All engines before 2007
www.steyr-motors.com
2179345/0-02-070118_tedoc

05.03 ill.6


STEYRMOTORS
INNOVATION WITH LIGHTNESS
WIRING DIAGRAM / MARINE - 4/6 CYLINDER - 2-POLE - 12V (OPTION)
Batt +
Batt -
Ign 15
Supplied by Relais
Sens ECU
Control ECU
DIAG
Start
Charge D+
Sens 5V
Sens -
B+ 24V
CAN
F1 - 50 A
F2 - 50 A
F3 - 50 A
F4 - 5 A
F5 - 10 A
F6 - 10 A
F7 - 10 A
CONNECTOR "A5" (ENGINE-CONTROL-UNIT)
STARTER
Start Ass.
Opt. Sender Trim
Aktor
Glow
Glow Ass.
Main
Start
Fuel
Speed
Map
Rack
Cmd
EXT
Ect
LPS
gear switch
Optional oil sender
Optional 24V
Invers
Solas
Batt +
Batt -
Wiring LPS / All engines before 2007
Wiring MAP / All engines before 2007
www.steyr-motors.com
2179350/0-02-070118_tedoc
05.03 ill.7


STEYRMOTORS
INNOVATION WITH LIGHTNESS
WIRING DIAGRAM / MARINE - 6 CYLINDER - 2-POL. - 24V - E-Box extern
Batt +
Batt -
Ign 15
Supplied by Relais
Sens ECU
Control ECU
DIAG
Start
Charge D+
Sens 5V
Sens -
B+ 24V
CAN
F1 - 50 A
F2 - 50 A
F3 - 50 A
F4 - 5 A
F5 - 10 A
F6 - 10 A
F7 - 10 A
F8 - 5 A
CONNECTOR "A5" (ENGINE-CONTROL-UNIT)
STARTER
Opt. Sender Trim
Aktor
Glow Ass.
Main
Start
Glow
Batt +
Batt -
Batt + / 24V
Batt - / 24 V
Optional oil sender
gear switch
Speed
Map
Rack
Cmd
EXT
Ect
LPS
Wiring LPS / All engines before 2007
Wiring MAP / All engines before 2007
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2179351/0-02-070118_tedoc

05.03 ill.8

06.06 ELECTRONICS - GENERAL

Wiring

In case of necessary repair of a cable connection, take special care that cable quality, isolation, crimping, strand end soldering of cable sockets as well as protective varnish isolation and/or connector locks meet the respective requirements.

Tools for crimp connections to be found in tool catalog P/N Z001002/0 "Level 4".

06.06.01 Electronic Engine Management System

The **STEYR Marine engine** is equipped with an Electronic Management System (EMS) that performs the following:

* controls engine functions to ensure maximum efficiency.
* self-diagnostic to protect the engine from damage if operating parameter are exceeded.
* stores diagnostic data of EMS server circuits for maintenance and service.

Engine power is reduced if:

Operating Parameter	Effect noticed	Panel Indication	Additional Tool-Readings	Action or possible reason
High engine coolant temperature limit exceeded	Reduction of engine speed	Horn ON 2x p. sec. Gauge reading > 107 °C	Steyr Diag Power limitation	See table trouble shooting: Cooling system
Defect - engine coolant sensor or sensor connection	Reduction of engine speed	Horn ON 2x p. sec. Gauge reading > 120 °C	Steyr Diag Service code	Sensor or connector failure; see service code table
Exhaust temperature limit exceeded	Reduction of engine speed	Horn and indication light "CEL" ON 2x p. sec.	Steyr Diag Power limitation	See table trouble shooting: Raw water cooling system
Defect - Exhaust temperature sensor or sensor connection	Reduction of engine speed	Horn and indication light "CEL" ON 2x p. sec.	Steyr Diag Service code	Sensor or connector failure; see service code table
Oil pressure below limit	Reduction of engine speed	Horn continuos and Oil indication light continuos switched ON	Steyr Diag Power limitation	See table trouble shooting: Engine oil system
Defect - Oil pressure sensor or sensor connection	Reduction of engine speed	Oil pressure indication light switched ON 1x p. sec.	Steyr Diag Service code	Sensor or connector failure; see service code table
Insufficient boost pressure or defictive sensor	Reduction of engine speed		Steyr Diag Power limitation	See table trouble shooting: Air charge system

Operating Parameter	Effect noticed	Panel Indication	Additional Tool-Readings	Action or possible reason
Engine speed sensor fault	Higher or unstable idle speed, limited performance	No RPM inication on tachometer	Steyr Diag Service code	See table trouble shooting: Speed sensor
Engine speed remains at idle	No increase of engine speed if throttle is moved to max.		Steyr Diag Service code	See table trouble shooting: Accelerator potentiometer failure
Governor position system	Irregular engine speed or stalled engine		Steyr Diag Service code	See table trouble shooting: Governing system
Inverse position shut down **(SOLAS)**	Engine shut down beyond 70° deg. angle	After engine stop horn remains switched ON until ignition reset		Reset through ignition OFF and then ON
During break in phase	Cel-ON at high accelerator position (more than 75%)	Indication light "CEL" is switched ON	Steyr Diag Break-in phase	See information break in procedure

Optical and audible warning signals as shown on the dash board, are illustrated in chapter **"Operating Status and Error Report"**

06.06.02 Diagnostic system

The electronic engine management system controls the following parameters:

Oil pressure, boost pressure, coolant temperature, hi-riser (bend) temperature.

The electronic engine management system has an automatic self-test program checking all data of electronic sensors. As soon as a fault is found, there is an optical or audible signal (refer to chart "Error Codes").

Occurred faults remain stored until cancellation. Stored faults may be selected, analyzed and cancelled by means of PC via diagnostic outlet.

A reference to one or several stored faults is the 5 second "TESTING" of the "CHECK-ENGINE LAMP" and the "WARNING HORN" after ignition ON, instead of usual 0,7 seconds. (refer to chart "Operating Status")

On the CHECK-ENGINE lamp (E) stored faults may be indicated by flashing codes. (With a special procedure, (06.06.04) individual cancellation is possible.) Error codes are regarded both as flashing codes as will as display by diagnostic instrument.

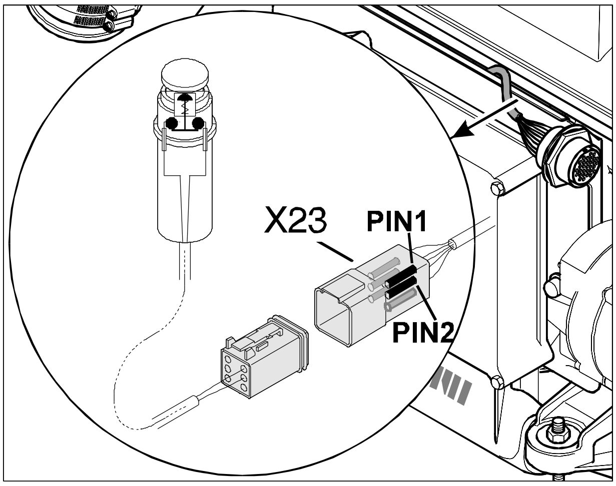
There are three fault categories: temporary faults, non essential faults and essential faults.

06.06.03 Reading Error Codes

Entering and reading of stored faults via Check Engine Lamp and Diagnostic Outlet Plug (X 23):

Needed device:
Tool No. VR00135/1
(normally closed push button switch)
connected to Diagnostic Outlet Plug X23.

In case this tool is not available:
Connect temporarily Pin - Pos. 1 with Pin - Pos. 2 of Diagnostic Plug X 23
(before ignition is turned on at key switch)

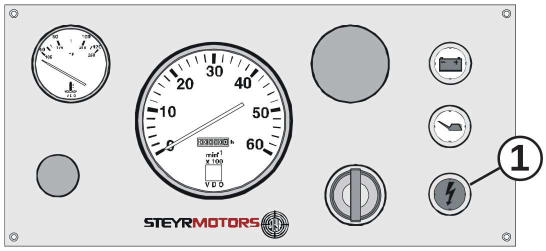


06.03 ill.1

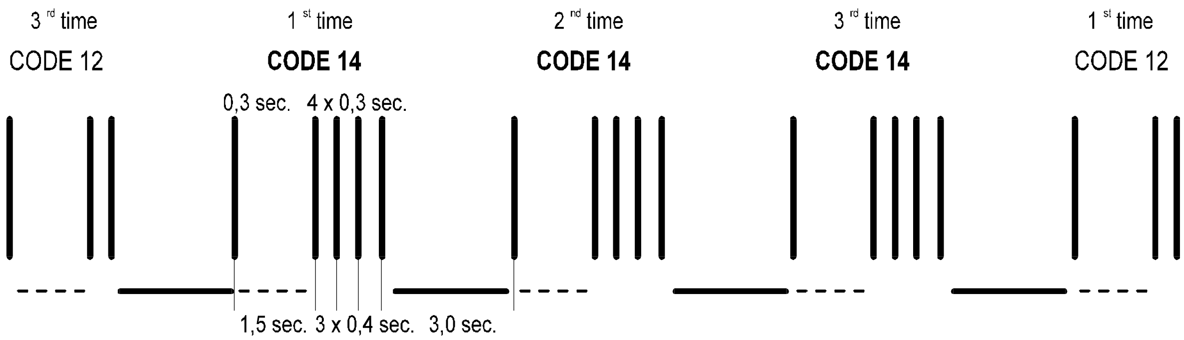
Code indication and indication sequence:

After entering the error code indication modus the Engine Management System will display a blink code at the Check Engine Light on the dash panel.
The blinking sequence will always begin and end with control code indication # 12. Each ERROR CODE will be repeated **3** times to reassure your correct reading – see below bar code illustration.

Example sequence check engine light (ill.2/pos.1):
Error code # 14



06.03 ill.2



06.03 ill.3

Stroke = Check Engine Light illuminated for 0,3 sec. (Light Off - period within blink sequence 0,4 sec.)

Dashed Line = interruption within code indication 1,5 sec.

Solid Line = interval interruption between error code 3,0 sec.

If more then one error code is stored in the Engine Management System the indication sequence will be continued blinking additional stored error codes. To delete a memorized error code see description Indication and Cancellation of memorized sensor and circuit faults.
For a description of the possible error codes refer to enclosed Table – Error Codes

ATTENTION: To exit from Error code indication. Tool VR00135/1 must be removed (connection between Pin 1 to Pin 2 opened) before ignition is turned ON again.

06.06.04 Indication and Cancellation of memorized sensor and circuit faults

Selection and clearing of stored error codes:

Procedure:

* Ignition — OFF

* Connect Tool VR00135/1 to Diagnostic Outlet Plug (X 23) – see 06.03 ill.1

* Ignition — ON
  Note: The program changes automatically to indication of error codes.
  If no error code is stored, only repeating control code reading “ Code # 12 “ will be displayed.
  Possible memorized codes are indicated as shown in the previous illustrated example (blinking 3x Code # 12 i. e. 3x error code # 14 etc.) The sequence will be prolonged with additional codes if more then one error code is stored.
  See Table – Error codes for description

* To delete a determined error code from the Engine Management System concentrate for the 3rd times flashing the desired error code. While this error code is displayed the third time the button (Tool VR00135/1) must be pushed and kept in this position (contact open).

* The indication on the Check Engine Light changes to a fast blinking of the lamp (app. 4 times per sec.). During this rapid flashing light the push button must be released (close contact after app. 2 sec.) to delete this error code.

  Note: Any other error code have to be selected and cleared individually following the above mentioned procedure to delete a determined error code.

  Note: An error code can only be deleted if no defect exists in this circuit. In case of a present active failure, the error code keeps reappearing until the problem has been repaired and the circuit is properly working again.

* Disconnect Tool VR00135/1 from Diagnostic Outlet Plug (X 23) to exit from error code display.

  Note: Watch indication of the Check Engine Light and the Warning Horn after ignition contact. If all error codes are deleted from the Engine Management System the indication resumes to 0.7 sec. function test of Check Engine Light and the Warning Horn.
  For more details see Chart – Operating Conditions - Instrument panel.

06.06.05 Principle failure code list

NOTE: Some codes may not apply due to different application!

CODE	ABBREV.	REFER TO CIRCUIT	INVOLVED DEVICE	POSSIBLE CAUSE
12	Control code			this code is designated for beginning or end of loop
13	LoMap	X12/B12	boost pressure sensor	signal level too low (short circuit or missing contact)
14	HiMap	X12/B12	boost pressure sensor	signal level too high (missing connection)
17	LoEXH	X17/B17	air charge temp. sensor	signal level too low (short circuit or missing contact)
18	HiEXH	X17/B17	air charge temp. sensor	signal level too high (missing connection)
21	LoECT	X16/B16	water temp. sensor	signal level too low (short circuit or missing contact)
22	HiECT	X16/B16	water temp. sensor	signal level too high (missing connection)
23	LoPed1	X13/B13	potentiometer accelerator	signal level entry too low
24	HiPed1	X13/B13	potentiometer accelerator	signal level entry too high
25	LoVPWR	F5/K27	main relay	low voltage supply to ECU, F5, K27
26	HiVPWR	F5/K27	main relay	too high voltage on VPROT input
27	LoVREF	X5/Z3	module, connector	too low voltage on sensor supply, possible short circuit
28	HiVREF	X5/Z1	module, connector	too high voltage on sensor supply
29	PedS	X13/B13	accelerator potentiometer	defect on pedal safety switch, pin 1-2
31	LoLPS	X18/B18	lubricant pressure sensor	signal level too low (short circuit or missing contact)
32	HiLPS	X18/B18	lubricant pressure sensor	signal level too high (missing connection)
33	LoPed2	X13/B13	potentiometer accelerator	signal level too low
34	HiPed2	X13/B13	potentiometer accelerator	signal level too high (missing connection)
35	LoRPos	X14/B14	rack position sensor	signal level too low (short circuit or missing contact)
36	HiRPos	X14/B14	rack position sensor	signal level too high (missing connection)
37	LoLOP	X18/B18	lubricant pressure sensor	signal level too low (short circuit)
38	HiLOP	X18/B18	lubricant pressure sensor	signal level too high (missing connection)
53	N_RFI	X15/B15	RPM-sensor	radio interference / sensor input
54	BadSta	M1-Pin50	K28 start assist relay	no start signal from assist solenoid
55	NoPuls	X15/B15	RPM-sensor	no speed signal during crank
56	Srpos	Y14(B14)	refer to setting rack pos.	rack calibration bad/rack position outside tolerance field

CODE	ABBREV.	REFER TO CIRCUIT	INVOLVED DEVICE	POSSIBLE CAUSE
57	Rack0	Y14(B14)	refer to setting rack pos.	bad rack zero position
99	FMSpwm	X20/Y20	actuator / solenoid	defect in governor solenoid wire circuit (Y20, main relay K27-no frequency sent or govenor solenoid circuit connected)
161	HiVTGc	Y28	REA unit at turbo charger	defect in circuit of actuator turbo charger (short circuit)
162	LoVTGc	Y28	REA unit at turbo charger	defect in circuit of actuator turbo charger (missing connection)
164	CELs	L2	check engine lamp	Current limit exceeded (short circuit)
165	CELo	L2	check engine lamp	missing connection or bulb blown
167	FPR_s	K24	fuel pump relay	Current limit exceeded in relay circuit (short circuit)
168	FPR_o	K24	fuel pump relay	no current detected in relay circuit (disconnection)
177	MR_s	K27	main relay	no current detected in main relay circuit (short circuit)
178	MR_o	K27	main relay	no current detected in main relay circuit (disconnection)
181	WarnLs	L3	oil pressure lamp	Current limit exceeded (short circuit)
182	WarnLo	L3	oil pressure lamp	no current in circuit of oil pressure lamp
186	BadPos	Y20	governor solenoid	Nominal-actual value difference (rack pos. error, rack jammed)
187	HiFMSC	X20/X20	governor solenoid	defect in governor wire circuit (resistance too high) (bulb blown or missing connection)
188	LoFMSc	X20	governor solenoid	defect in governor wire circuit (resistance too low)
193	VTG_Bad	Y28	REA unit at turbo charger	defect in output circuit (short circuit or missing connection)
194	GPR_s	K26	glow assist relay	current limit exceeded in glow plug relay circuit (short circuit)
195	GPR_o	K26	glow assist relay	no current detected in glow plug relay circuit (disconnection)
201	HiTEMP	--	operation limit exceeded - engine overheated	engine was operated with too high coolant temperature
202	Lop	--	operation limit exceeded - lubricant pressure too low	engine was operated with too low lubricant pressure
203	Manop	--	operation limit exceeded - rack position too high	engine operated with manual movement of rack
251	ITSL_Bad	B30	position sensor - ITD	signal level too low (short circuit) on injection timing sensor
252	ITV_LoCur	Y29	proportional valve - ITD	defect in circuit of valve (no current flow)
253	ITV_HiCur	Y29	proportional valve - ITD	defect in circuit of valve (current value too high)
254	SpvP_Bad	B30	position sensor or ITD	commanded timing position can not be achieved (sensor or injection timing device defect, eccenter shaft jammed)
255	Spv_INI	B30	reference-position sensor ITD	timing position calibration bad (position out of tolercance)

06.06.06 REPLACE FUSES

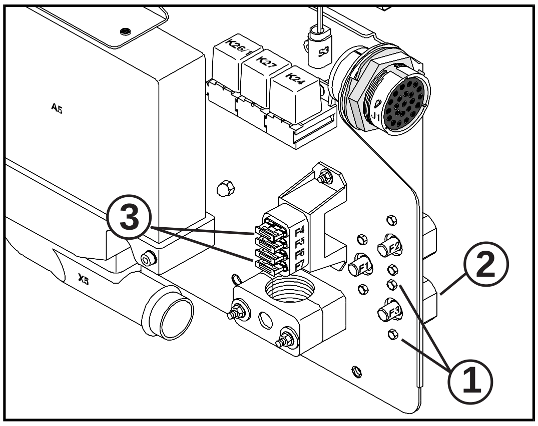
Preparatory works: Engine out of operation, disconnect battery.

Replace automatic circuit breaker

1 Swing off E-box base plate.

2 Disconnect cable from automatic circuit breaker.

3 Loosen 2 hexagon screws (ill.1/pos.1) (SW1/4") and take off thermal circuit breaker (ill.1/pos.2).



06.06 ill.1

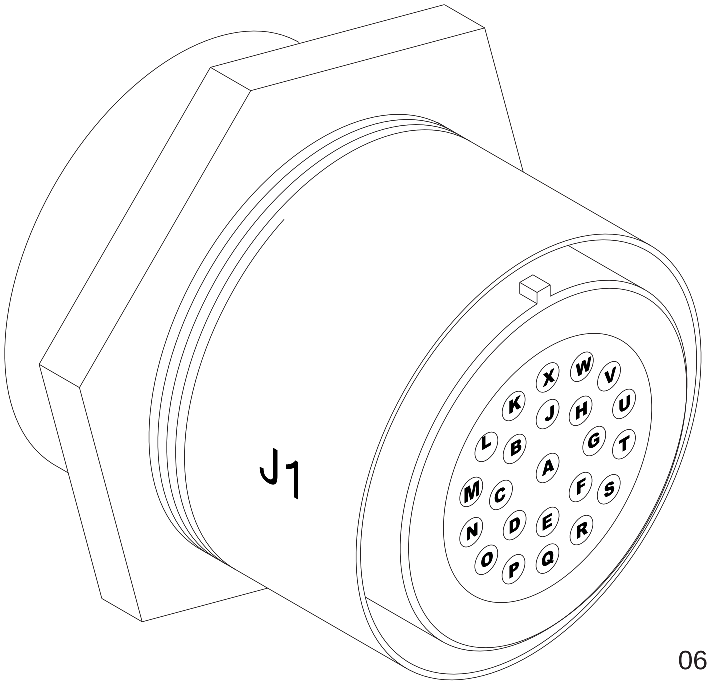
NOTE: For assembly, seal cable screw connections with rubber varnish.

Replace fuses

1 Remove E-box cover.

2 Remove fuse protection cap.
Pull out fuses (ill.1/pos.3)
Replace defect fuse.

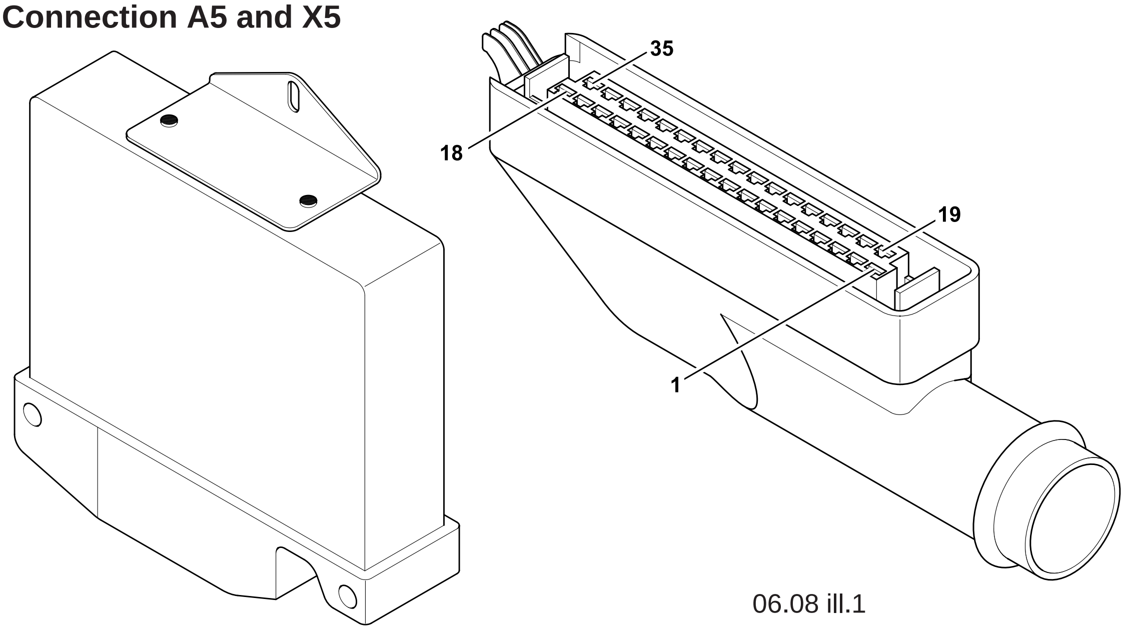
06.06.07 Connection J1



06.07 ill.1

Pin	Cable - no.	Explication
A	15000-01	ignition 15
B	15000-02	ignition 15
C	30012-07	terminal 30
D	30012-08	terminal 30
E	31000-01	ground connection
F	31000-02	ground connection
G	60616-01	lamp - oil pressure L3
H	31615-01	warning horn
J	60706-01	const. speed switch
K	60614-01	temperature display
L	61000-02	alternator D+
M		blind plug
N	60613-01	tachometer (speed)
O	60121-01	oil pressure gauge (optional)
P	60810-01	check engine lamp
Q	50000-02	ignition lock start
R	50000-03	ignition lock start
S	60120-01	trim (optional)
T	61001-02	alternator B+ 24V DC (ifused)
U	60901-03	CAN-low
V	60900-03	CAN-high
W		blind plug
X		blind plug

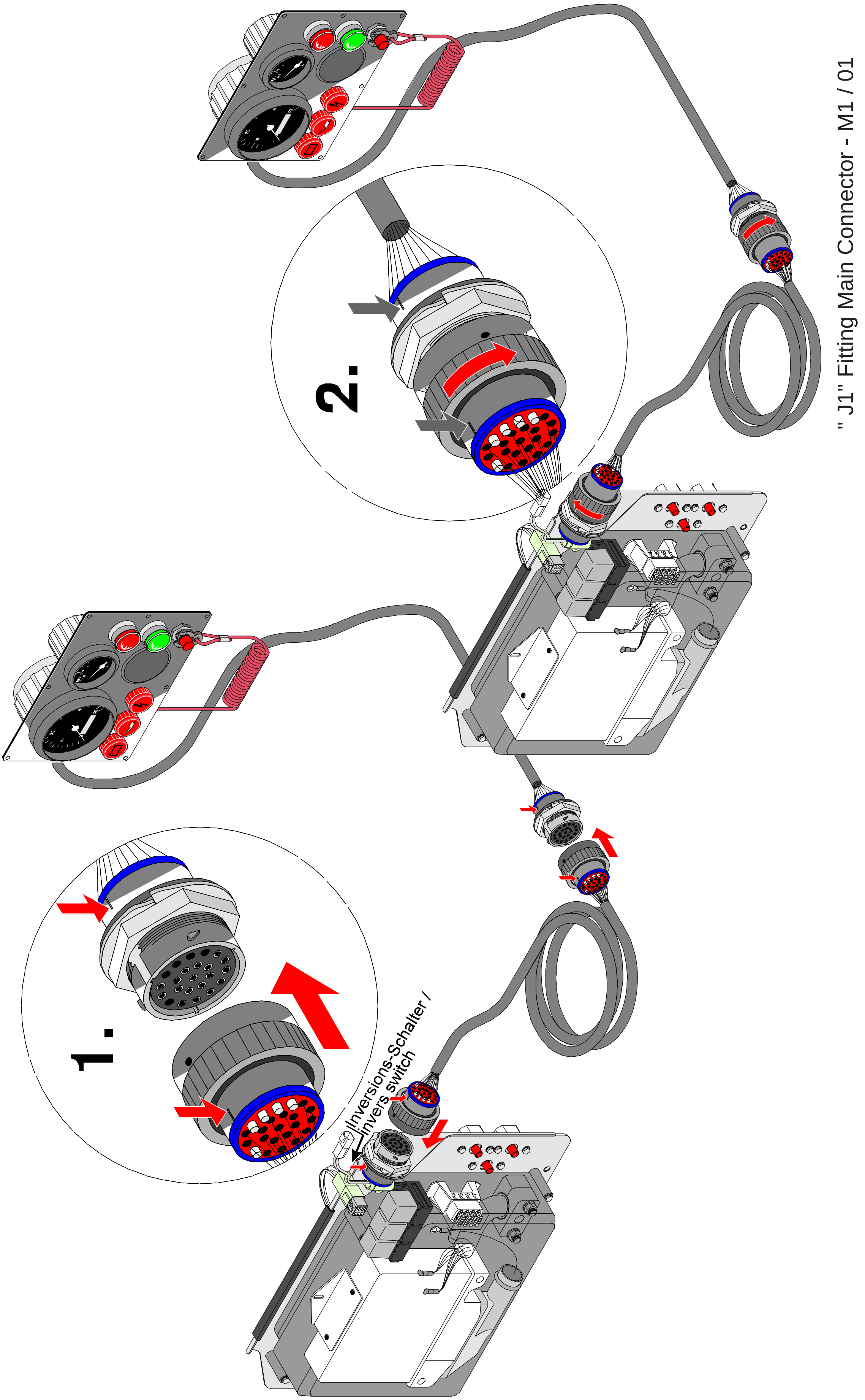
06.06.08 Connection A5 and X5



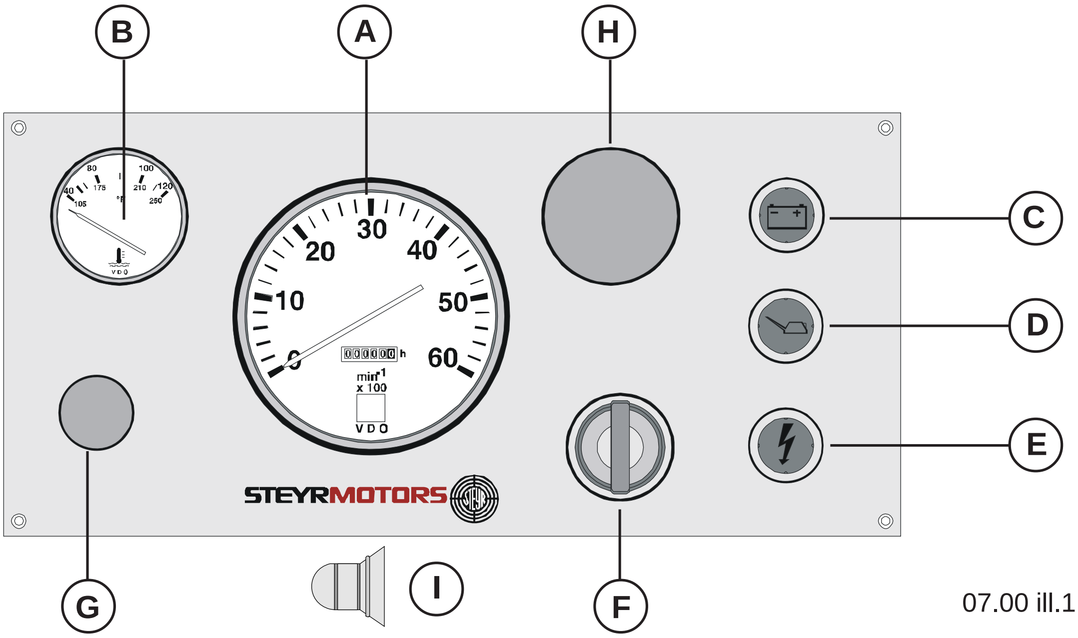
06.08 ill.1

Pin	Cable no.	Designation	Explication
1	30012 / 01	Vbat	terminal 30
2	31000 / 06	GND	terminal 31
3	15100 / 01	Vref	+ 5V
4	free	free	not busy
5	free	free	not busy
6	60616 / 01	GPL	oil pressure lamp L3
7	31555 / 01	GPR	preheating relay
8	60613 / 01	Tacho	speed instrument
9	60114 / 01	ECT	engine coolant temperature sensor
10	60117 / 01	LPS	oil pressure sensor
11	60112 / 01	RPOS	pot. rack position
12	60111 / 01	PED1	pedal 1
13	50000 / 01	CRI	start signal identification
14	60122 / 01	CLS	gear switch
15	60900 / 01	CANH	canbus high
16	60901 / 01	CANL	canbus low
17	15012 / 01	VPROT2	direct supply line to control solenoid
18	15012 / 02	VPROT	protected 12V (after K27 and protective wiring in governor)
19	15000 / 03	IGN	ignition terminal 15
20	31100 / 01	Gnd Vref	sensor ground connection
21	free	free	not busy
22	31554 / 01	FPR	fuel pump relay
23	60810 / 01	CEL	check engine lamp
24	31558 / 01	MR	main relay (K27)
25	31615 / 01	WOUT	warning horn
26	60614 / 01	TEMP	temperature display
27	60118 / 01	EXT	exhaust gas water temperature
28	60110 / 01	MAP	boost pressure sensor
29	60706 / 01	AUX	fixed speed
30	60116 / 01	PED2	pedal 2
31	60123 / 01	WS	warning switch / **Solas inversion switch**
32	60808 / 01	ISO	ISO 9141 (diag. cable)
33	60113 / 01	RPM	engine speed sensor
34	free	free	not busy
35	31409 / 01	FMS	approach line for control solenoid

06.06.09 Fitting main connector "J1" properly



06. 07. INSTRUMENT PANEL



07.00 ill.1

Instrument panel, standard

A	tachometer	**G**	blind plug - installation option for key switch constant revolution
B	engine temperature	**H**	blind plug - installation option for oil pressure gauge or voltmeter 12V
C	warning light - battery charge	**I**	audible warner (installed to rear side of paneel)
D	combined light preheating control & warning light engine oil pressure		
E	warning light check engine		
F	ignition key lock		

06. 07. 01 Chart - Operating Status

Instrument indication during normal operation

1. ignition ON (... until engine start)

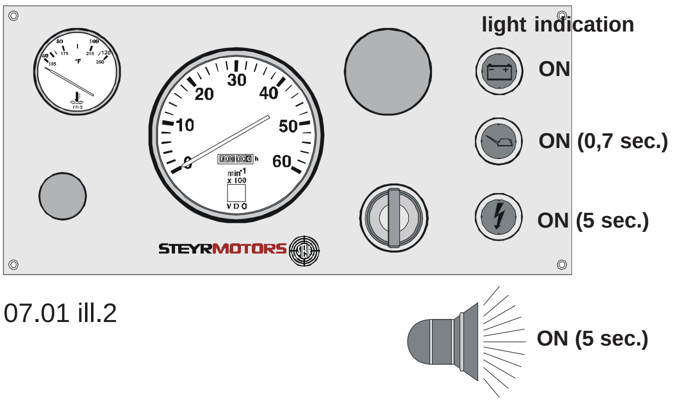


07.01 ill.1

System check - see light indication

NOTE:
At low temperature condition (cold weather) the combined light for glow plug preheating & warning light engine oil pressure will not extinguish after 0,7 sec. (glow plug preheating phase)
In this case start engine immediately after the light extinguishes.

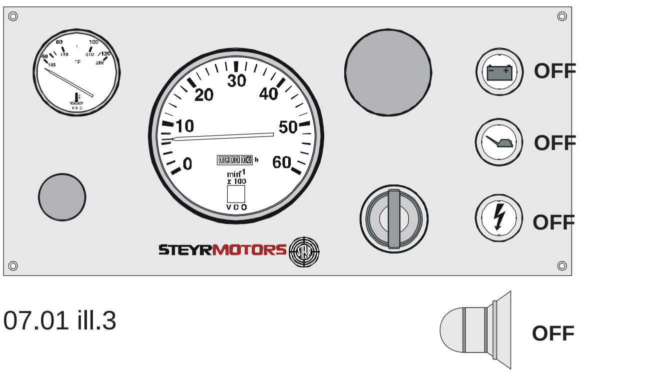
2. ignition ON (... until engine start)



07.01 ill.2

Indication active error

3. engine running after start

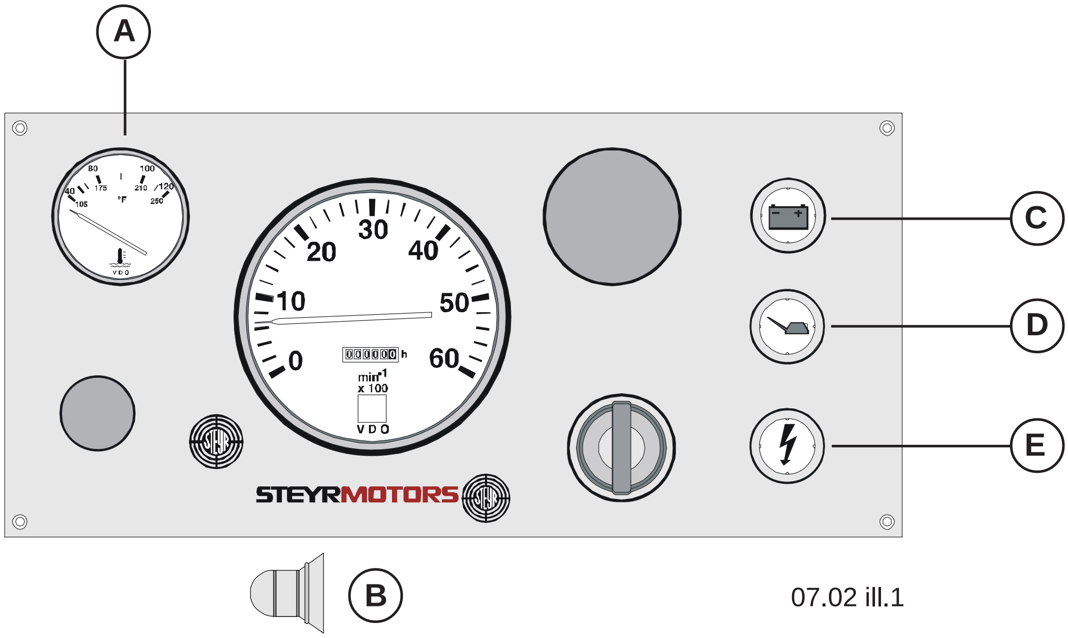


07.01 ill.3

Normal condition

NOTE:
Further information see:
"Table - Error indication on Instrument Panel"

06. 07. 02 Chart - Error indication on Instrument Panel

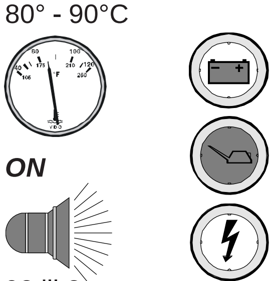
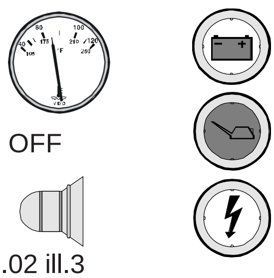
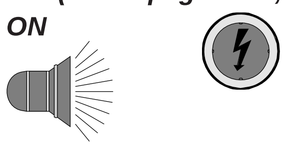


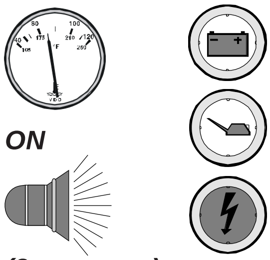
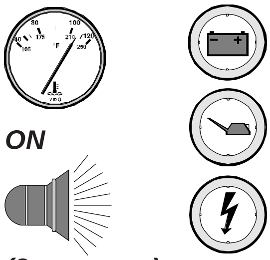
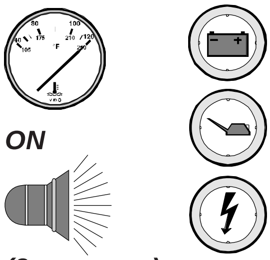
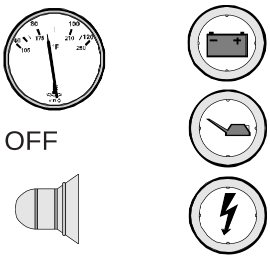
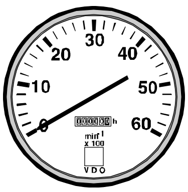
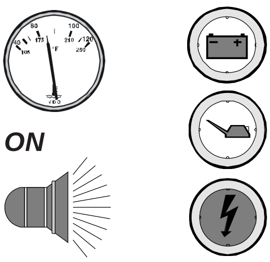
07.02 ill.1

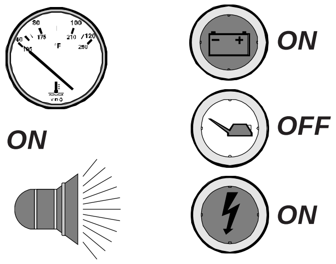
A	temperature gauge - coolant	**D**	combined light preheating control & warning light engine oil pressure
B	audible warner	**E**	warning light check engine
C	warning light - battery charge		

Operating condition: During normale engine operation, or indication in case of sensor defect while ignition is switched ON.

Event: Speed resp. performance limitation during engine operation

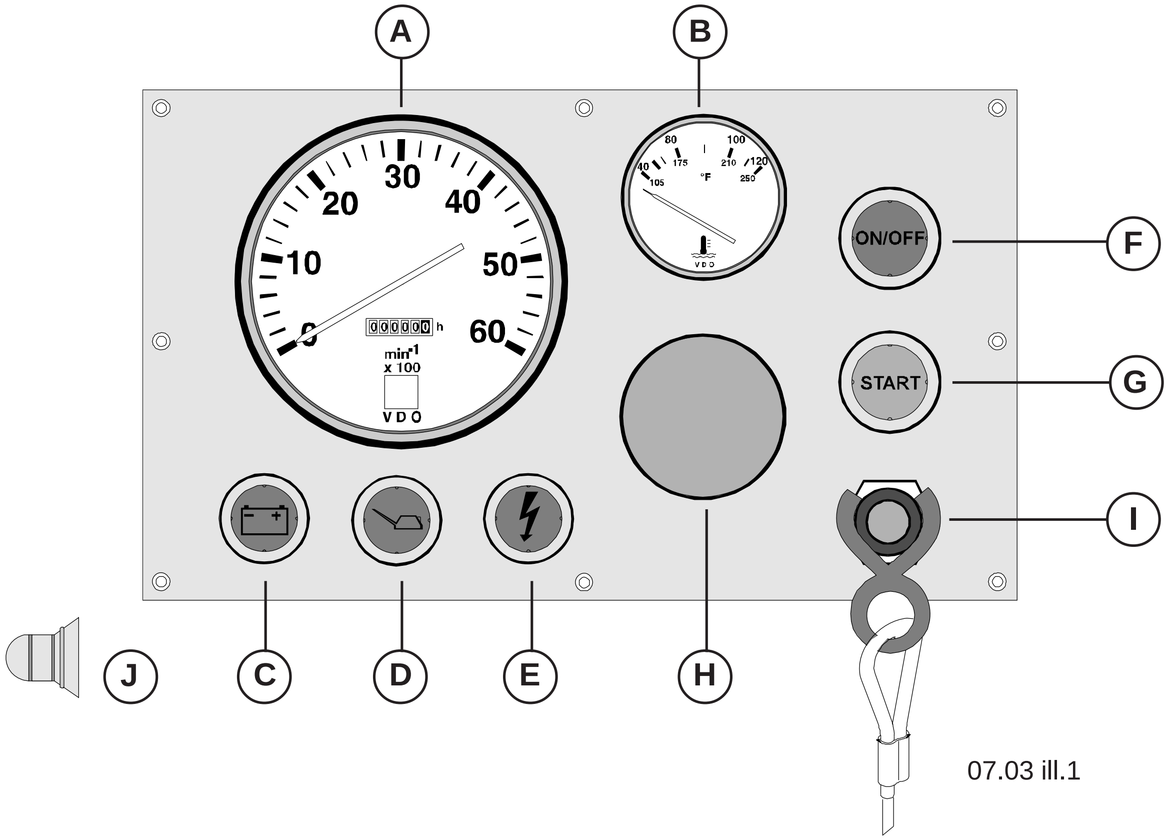
Indication status	Fault	Remarks
80° - 90°C  ***ON*** OFF, ***ON***, OFF 07.02 ill.2	**oil pressure below min. limit**	check oil level
80° - 90°C  OFF OFF, ***FLASHING (1x per sec.)***, OFF 07.02 ill.3	**fault oil pressure sensor or sensor connection**	check oil pressure sensor (B18) and connection
NOTE: (see cap. general, D3) ***ON***  ***ON***	**engine overload during break-in period**	reduce throttle position until light goes OFF (indication during first 2 hours of operation)

Indication status	Fault	Remarks
80° - 90°C  ON (2x per sec.) OFF OFF *FLASHING (2x per sec.)* 07.02 ill.4	**high exhaust temperature (off 80° C)**	check raw water system, strainer, impeller pump
high approx 105°C  ON (2x per sec.) OFF OFF OFF 07.02 ill.5	**engine coolant temperature to high**	after cooling down, check engine coolant level
120°C  ON (2x per sec.) OFF OFF OFF 07.02 ill.6	**defect engine coolant sensor or sensor connection**	after cooling down, check engine coolant level, sensor (B16) and connection
80° - 90°C  OFF OFF OFF OFF 07.02 ill.7	**instable idle speed, no indication on tachometer** 	defect speed sensor (B15) or sensor connection
80° - 90°C  ON OFF OFF *ON* 07.02 ill.8	**Trouble in governing loop, involved components: control solenoid, rack, control gear of unit injector, rack position sensor**	Failure in governing loop: time limit exceed for rack positioning. Restriction or high friction in control devices.Stored failure code must be cleared memory. Tool: PC-service program

Indication status	Fault	Remarks
During start attempt  07.02 ill.9	**Engine will not start. Failure in governing circuit**	Failure in governing circuit. Positioning of rack not possible. Trouble shooting of control solenoid, rack, control gear of unit injection, rack position sensor

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06.07.03 Instrument panel (for SOLAS only)



07.03 ill.1

A	tachometer with service hour meter	**G**	push button START (green)
B	temperature gauge - coolant	**H**	blind plug - installation option for oil pressure gauge or voltmeter 12V
C	warning light - battery charge		
D	combined light preheating control & warning light engine oil pressure		
E	warning light - check engine light	**I**	emergency cut off switch
F	push button - ignition ON/OFF (red)	**J**	audible warning device (installed to rear side of panel)

NOTE: Instrument gauges are automatically illuminated if ignition is turned ON.

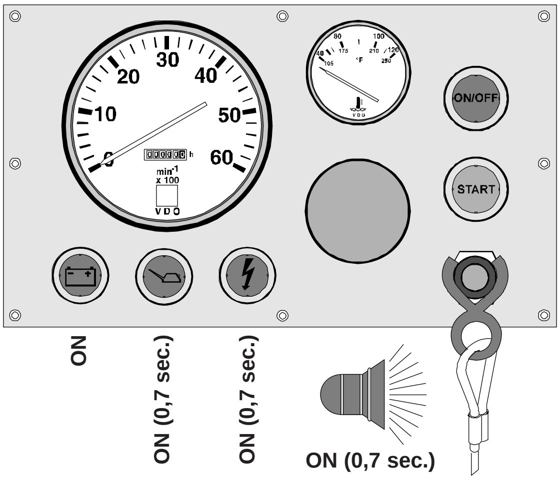
NOTE: In case an inversion occured, the engine gets shut down automatically to re-establish regular running and operation the push button Ignition (F) must be switched OFF and then ON again and engine must be restarted with push button START (G).

06.07.04 Chart - Operating Status (for SOLAS only)

Instrument indication during normal operation

1. ignition ON (... until engine start)

07.04 ill.1

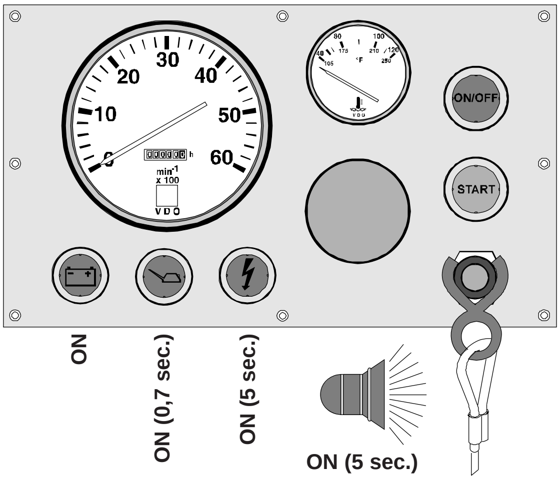


System check **-** see light indication

NOTE:
At low temperature condition (cold weather) the combined light for glow plug preheating & warning light engine oil pressure will not extinguish after 0,7 sec. (glow plug preheating phase)
In this case start engine immediately after the light extinguishes.

2. ignition ON (... until engine start)

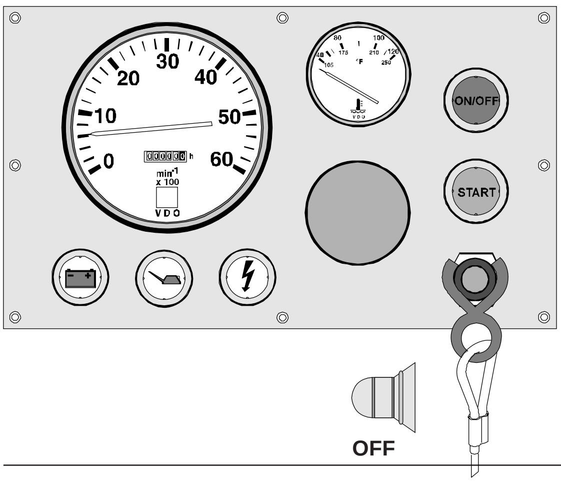
07.04 ill.2



Indication active error

3. engine running after start

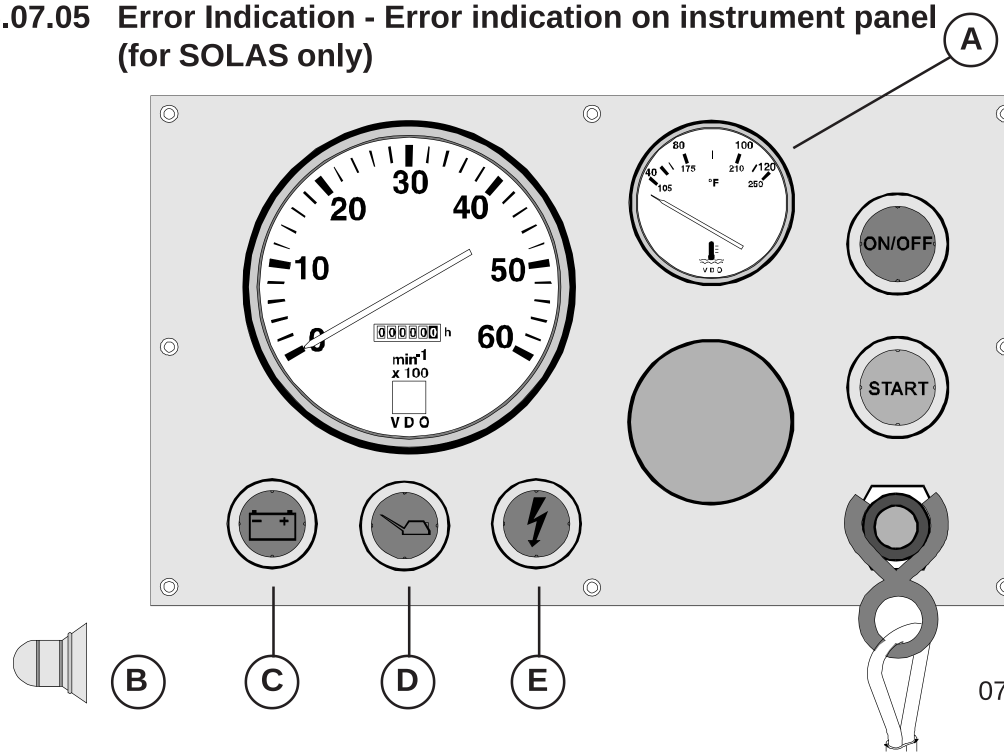
07.04 ill.3



Normal condition

NOTE:
Further information see:
"Table - Error indication on Instrument Panel"

06.07.05 Error Indication - Error indication on instrument panel (for SOLAS only)

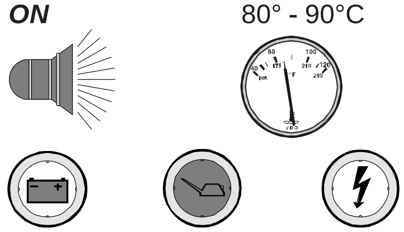
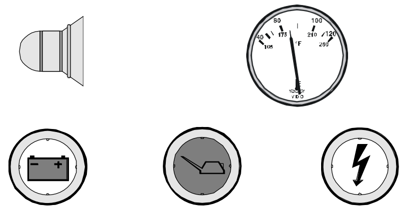
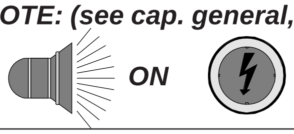


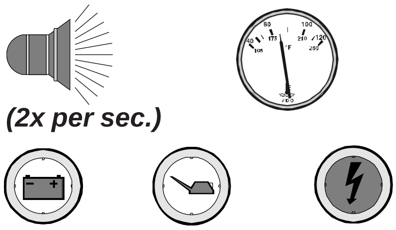
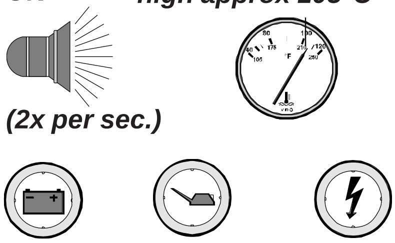
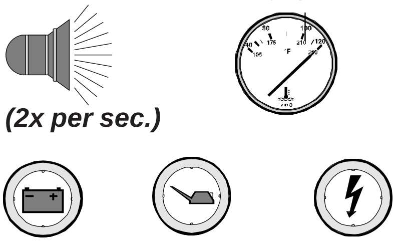
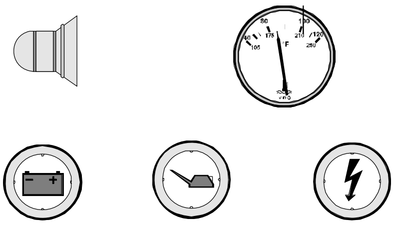
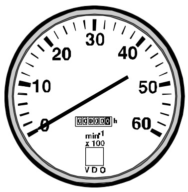
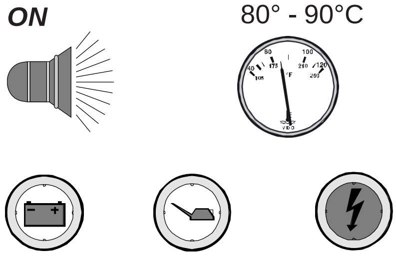
07.05 ill.1

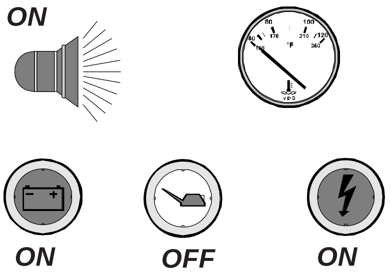
A	temperature gauge - coolant	**D**	combined light preheating control & warning light engine oil pressure
B	audible warning device	**E**	warning light - check engine light
C	warning light - battery charge		

Operating condition: During normal engine operation, or indication in case of sensor defect while ignition is switched ON.

Event: Speed resp. performance limitation during engine operation

Indication status	Fault	Remarks
ON 80° - 90°C  OFF ***ON*** OFF 07.05 ill.2	**oil pressure below min. limit**	check oil level
OFF 80° - 90°C  OFF ***FLASHING (1x per sec.)*** OFF 07.05 ill.3	**fault oil pressure sensor or sensor connection**	check oil pressure sensor (B18) and connection
NOTE: (see cap. general, D3)  ***ON*** ***ON***	**engine overload during break-in period**	reduce throttle position until light goes OFF (indication during first 2 hours of operation)

Indication status	Fault	Remarks
ON 80° - 90°C  ***(2x per sec.)*** OFF OFF ***FLASHING (2x per sec.)*** 07.05 ill.4	**high exhaust temperature (off 80° C)**	check raw water system, strainer, impeller pump
ON ***high approx 105°C***  ***(2x per sec.)*** OFF OFF OFF 07.05 ill.5	**engine coolant temperature to high**	after cooling down, check engine coolant level
ON ***120°C***  ***(2x per sec.)*** OFF OFF OFF 07.05 ill.6	**defect engine coolant sensor or sensor connection**	after cooling down, check engine coolant level, sensor (B16) and connection
OFF 80° - 90°C  OFF OFF OFF 07.05 ill.7	**instable idle speed, no indication on tachometer** 	defect speed sensor (B15) or sensor connection
ON 80° - 90°C  OFF OFF ***ON*** 07.05 ill.8	**Trouble in governing loop, involved components: control solenoid, rack, control gear of unit injector, rack position sensor**	Failure in governing loop: time limit exceed for rack positioning. Restriction or high friction in control devices.Stored failure code must be cleared memory. Tools: PC-service program

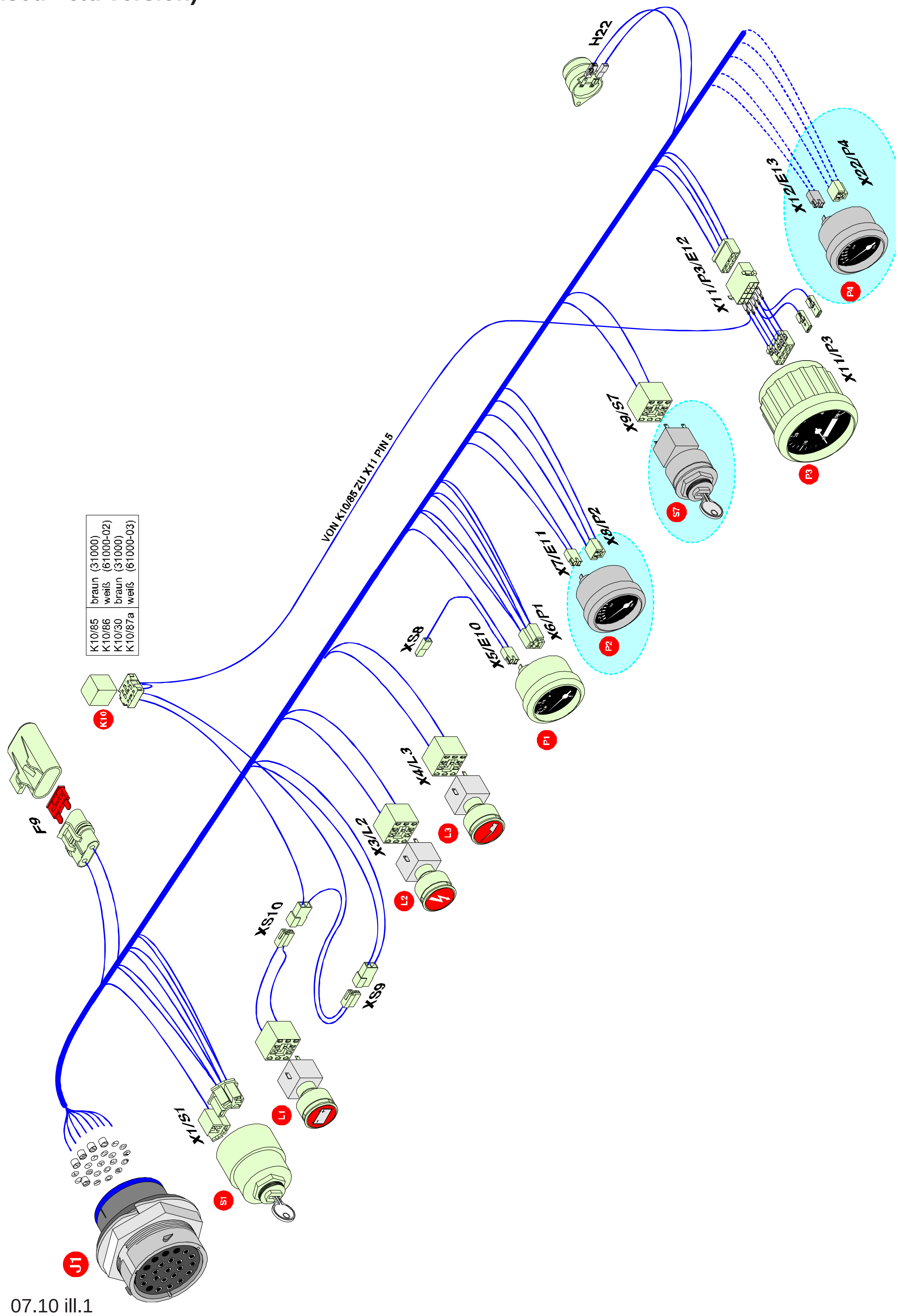
Indication status	Fault	Remarks
During start attempt  07.05 ill.9	**Engine will not start. Failure in governing circuit**	Failure in governing circuit. Positioning of rack not possible. Trouble shooting of control solenoid, rack, control gear of unit injection, rack position sensor

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06. 07. 10 6 Cyl. Wiring harness instrument panel (if alternator "PRESTOLITE" is used - old version)

Designat.	Component	Description
F9	fuse	
J1	23-pin plug	connection engine cable - instrument cable
S1	switch	ignition
S7	switch	fix-n (speed-selector switch optional)
K10	relay	charge control (90A PRESTOLITE)
L1	lamp	charge control
L2	lamp	cel - check engine lamp
L3	lamp	oil pressure / pre-heating control
P1	gauge	coolant
P2	gauge	oil pressure (optional)
P3	gauge	tachometer with running-time meter
P4	gauge	trim (optional)
H22	warning horn	
XS8	1-pin plug	to lighting switch - instrument panel
XS9	2-pin plug	charging control/relay charging control (wiring harness side)
XS10	2-pin plug	charging control/relay charging control (instrument side)
X1/S1	4-pin plug	ignition
X2/L1	10-pin plug	charge control lamp
X3/L2	10-pin plug	cel - check engine lamp
X4/L3	10-pin plug	oil pressure warning lamp
X5/E10	2-pin plug	lighting coolant display
X6/P1	3-pin plug	coolant temperature gauge
X7/E11	2-pin plug	lighting oil pressure
X8/P2	3-pin plug	oil pressure gauge
X9/S7	10-pin plug	speed-selector switch (optional)
X11/P3/E12	8-pin plug	speed instrument / lighting speed instrument
X12/E13	2-pin plug	lighting trim (optional)
X22/P4	3-pin plug	trim (optional)

6 Cyl. Wiring harness instrument panel (if alternator "PRESTOLITE" is used - old version)

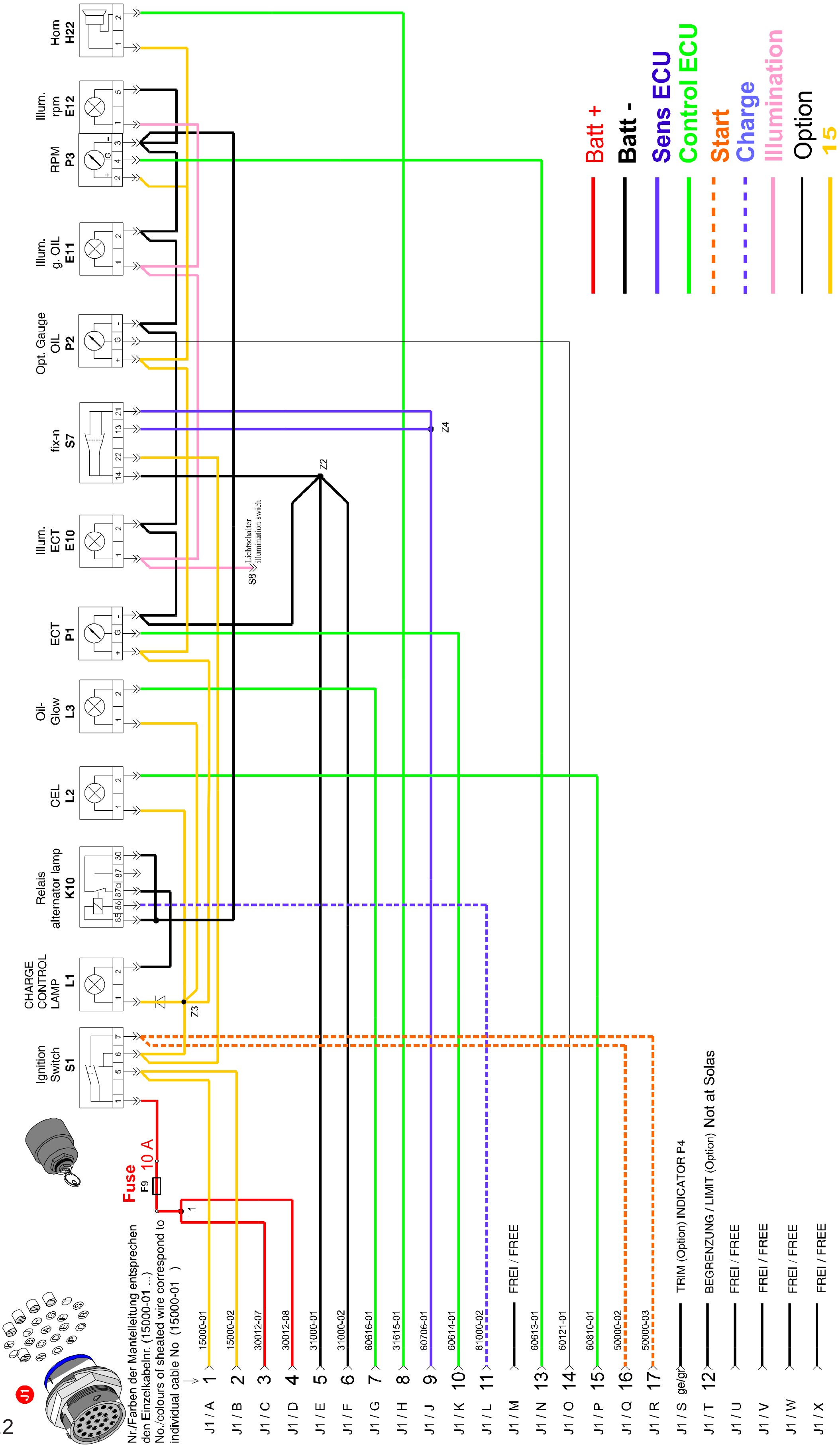


07.10 ill.1

6 Cyl. Wiring harness instrument panel (if alternator "PRESTOLITE" is used - old version)

Designat.	Component	Description
F9	fuse	
J1	23-pin plug	connection engine cable - instrument cable
S1	switch	ignition
S7	switch	fix-n (speed-selector switch optional)
K10	relay	charge control (90A PRESTOLITE)
L1	lamp	charge control
L2	lamp	cel - check engine lamp
L3	lamp	oil pressure / pre-heating control
P1	gauge	coolant
P2	gauge	oil pressure (optional)
P3	gauge	tachometer with running-time meter
P4	gauge	trim (optional)
H22	warning horn	
XS8	1-pin plug	to lighting switch - instrument panel
XS9	2-pin plug	charging control/relay charging control (wiring harness side)
XS10	2-pin plug	charging control/relay charging control (instrument side)
X1/S1	4-pin plug	ignition
X2/L1	10-pin plug	charge control lamp
X3/L2	10-pin plug	cel - check engine lamp
X4/L3	10-pin plug	oil pressure warning lamp
X5/E10	2-pin plug	lighting coolant display
X6/P1	3-pin plug	coolant temperature gauge
X7/E11	2-pin plug	lighting oil pressure
X8/P2	3-pin plug	oil pressure gauge
X9/S7	10-pin plug	speed-selector switch (optional)
X11/P3/E12	8-pin plug	speed instrument / lighting speed instrument
X12/E13	2-pin plug	lighting trim (optional)
X22/P4	3-pin plug	trim (optional)

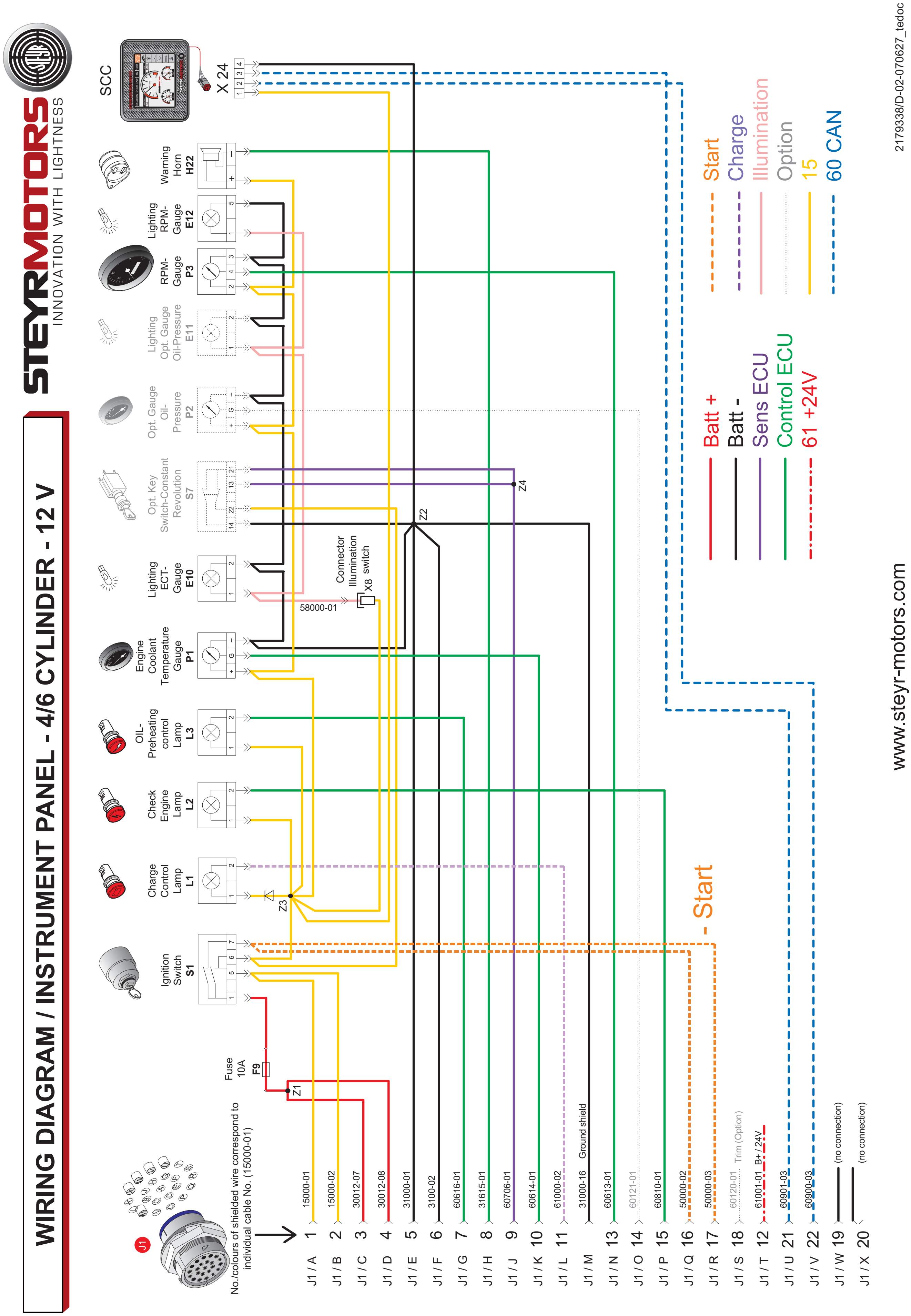
6 Cyl. Wiring harness instrument panel (if alternator "PRESTOLITE" is used - old version)

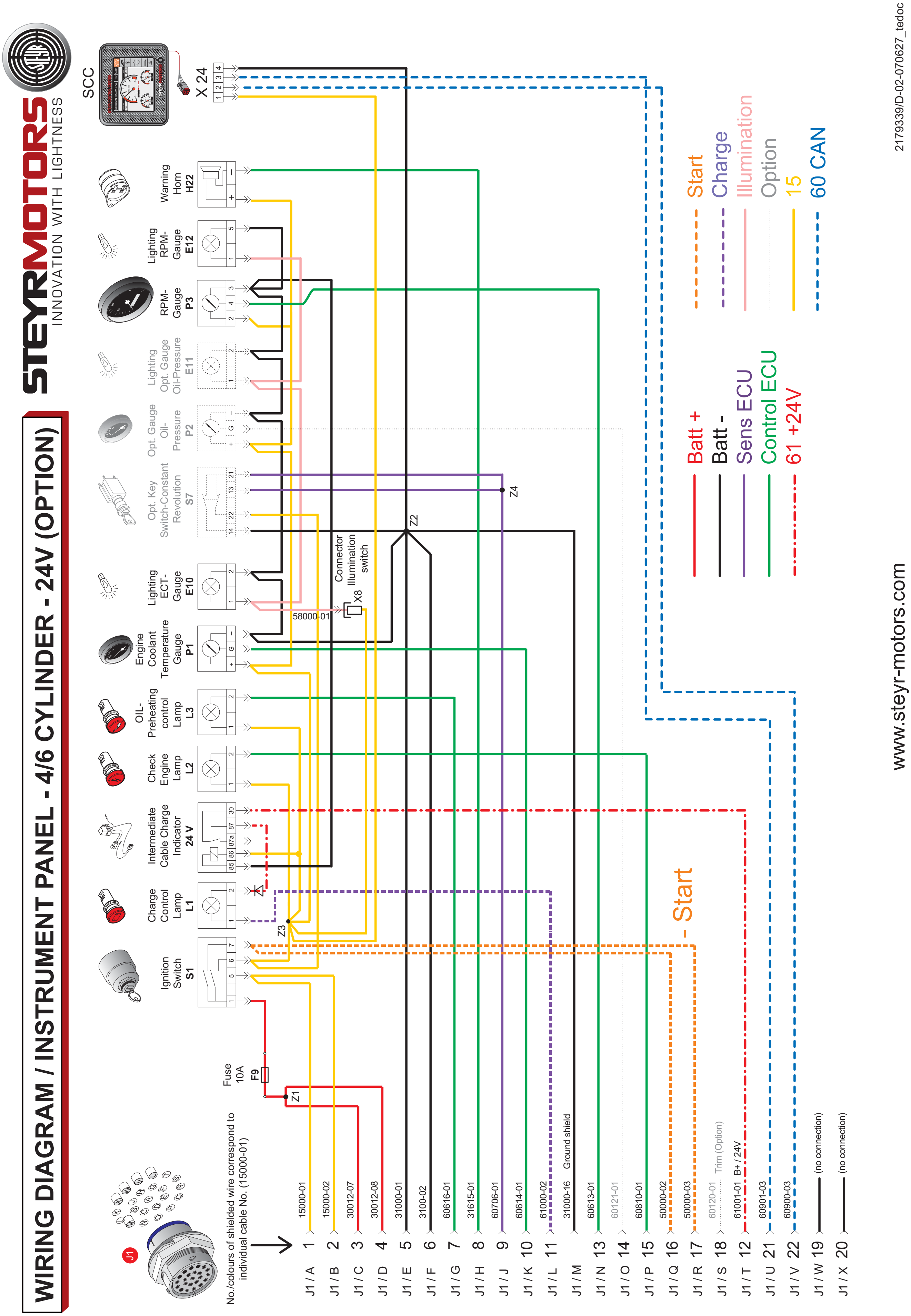


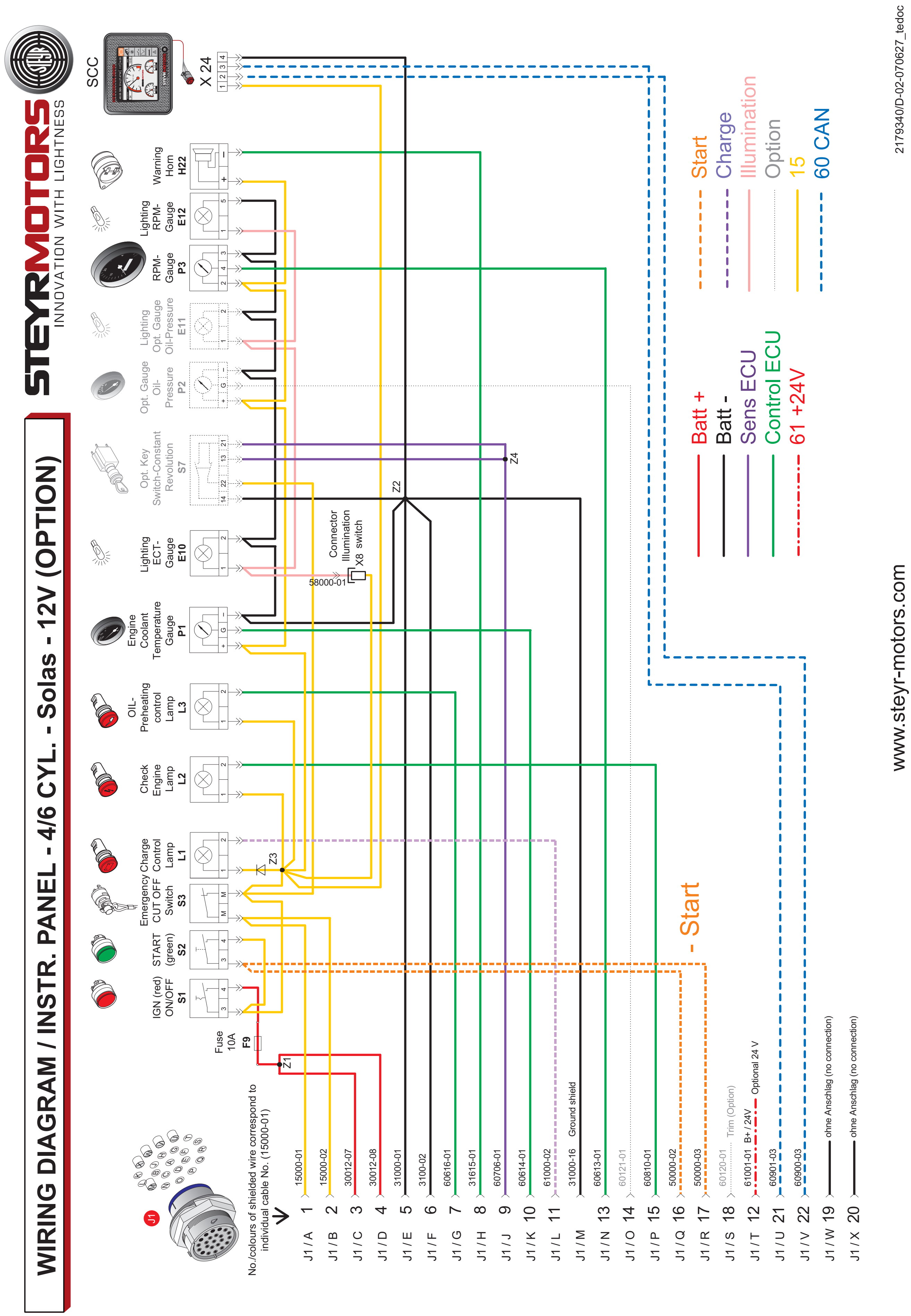
07.10 ill.2

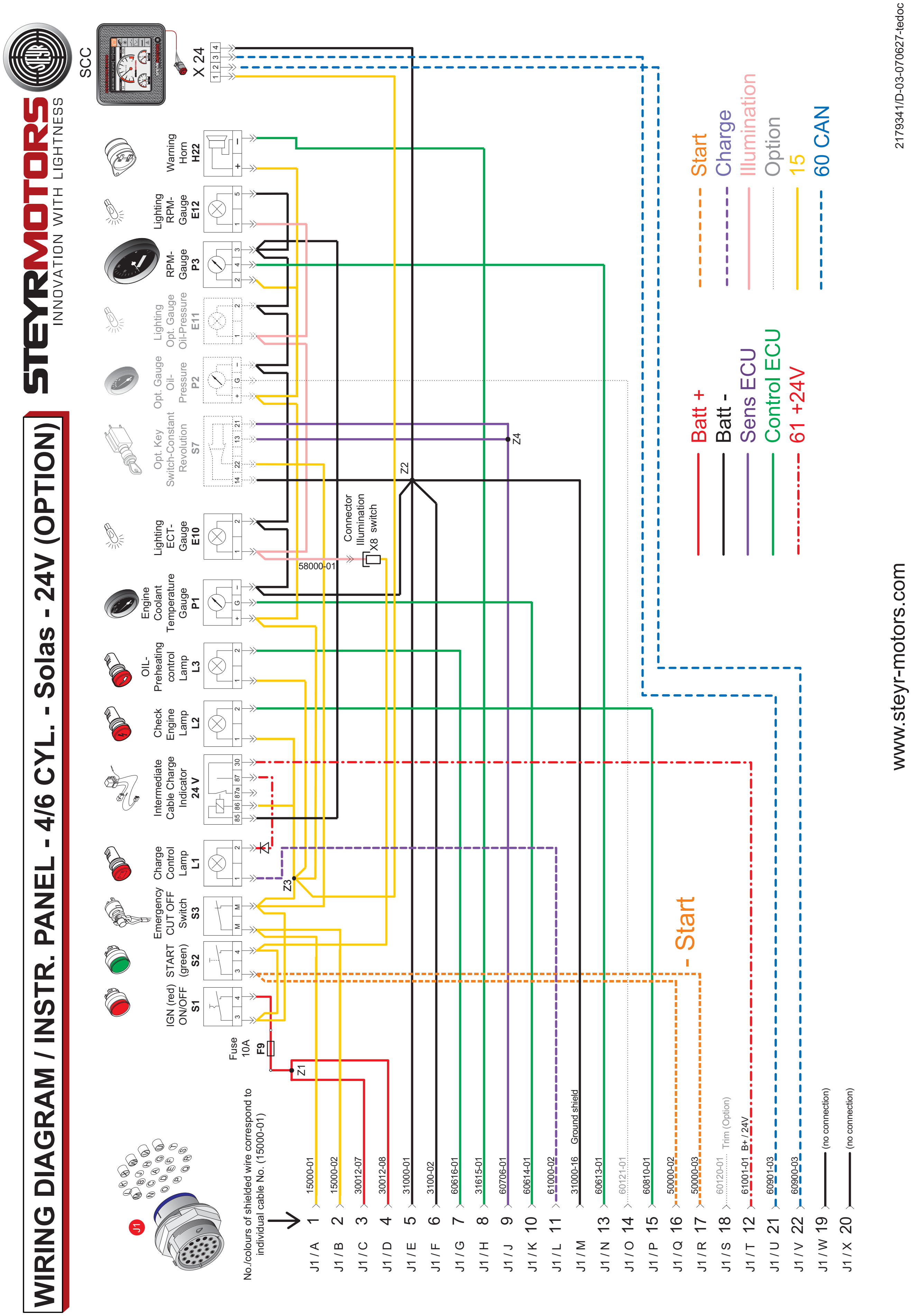
06. 07. 11 Description - Wiring harness instrument panels 4/6 cyl. marine engines (current version)

Designat.	Component	Description
F9	fuse 10 A	
J1	23-pin plug	connection engine cable - instrument cable
S1	switch	ignition (red)
S2	switch	start (green)
S3	switch	emergency cut off (orange)
S7	switch	key switch constant revolution (optional)
L1	lamp	charge control
L2	lamp	cel - check engine lamp
L3	lamp	oil pressure / preheating conrol
P1	gauge	engine coolant temperature
P2	gauge	oil pressure (optional)
P3	gauge	tachometer with running-time meter
H22	warning horn	
E10	lighting	engine coolant temperature gauge
E11	lighting	oil pressure gauge (optional)
E12	lighting	tachometer gauge
X8	1-pin plug	connector illumination switch
X24	8-pin plug	connector STEYR - display
Z1	splice	battery +
Z2	splice	battery -
Z3	splice	ignition (+)
Z4	splice	key switch constant revolution
24 V	interm. cable	charge indicator


WIRING DIAGRAM / INSTRUMENT PANEL - 4/6 CYLINDER - 12 V
STEYRMOTORS
INNOVATION WITH LIGHTNESS
SCC
X 24
Warning Horn H22
Lighting RPM-Gauge E12
RPM-Gauge P3
Lighting Opt. Gauge Oil-Pressure E11
Opt. Gauge Oil-Pressure P2
Opt. Key Switch-Constant Revolution S7
Lighting ECT-Gauge E10
Engine Coolant Temperature Gauge P1
OIL-Preheating control Lamp L3
Check Engine Lamp L2
Charge Control Lamp L1
Ignition Switch S1
Fuse 10A F9
Connector Illumination switch X8
58000-01
Z1
Z2
Z3
Z4
J1
No./colours of shielded wire correspond to individual cable No. (15000-01)
J1 / A 1 15000-01
J1 / B 2 15000-02
J1 / C 3 30012-07
J1 / D 4 30012-08
J1 / E 5 31000-01
J1 / F 6 3100-02
J1 / G 7 60616-01
J1 / H 8 31615-01
J1 / J 9 60706-01
J1 / K 10 60614-01
J1 / L 11 61000-02
J1 / M Ground shield 31000-16
J1 / N 13 60613-01
J1 / O 14 60121-01
J1 / P 15 60810-01
J1 / Q 16 50000-02
J1 / R 17 50000-03
J1 / S 18 60120-01 Trim (Option)
J1 / T 12 61001-01 B+ / 24V
J1 / U 21 60901-03
J1 / V 22 60900-03
J1 / W 19 (no connection)
J1 / X 20 (no connection)
- Start
Batt +
Batt -
Sens ECU
Control ECU
61 +24V
Start
Charge
Illumination
Option
15
60 CAN
www.steyr-motors.com
2179338/D-02-070627_tedoc


WIRING DIAGRAM / INSTRUMENT PANEL - 4/6 CYLINDER - 24V (OPTION)
STEYRMOTORS
INNOVATION WITH LIGHTNESS
SCC
X 24
Warning Horn H22
Lighting RPM-Gauge E12
RPM-Gauge P3
Lighting Opt. Gauge Oil-Pressure E11
Opt. Gauge Oil-Pressure P2
Opt. Key Switch-Constant Revolution S7
Lighting ECT-Gauge E10
Engine Coolant Temperature Gauge P1
OIL-Preheating control Lamp L3
Check Engine Lamp L2
Intermediate Cable Charge Indicator 24 V
Charge Control Lamp L1
Ignition Switch S1
Fuse 10A F9
Z1
Z2
Z3
Z4
Connector Illumination switch X8
58000-01
J1
No./colours of shielded wire correspond to individual cable No. (15000-01)
J1 / A 1 15000-01
J1 / B 2 15000-02
J1 / C 3 30012-07
J1 / D 4 30012-08
J1 / E 5 31000-01
J1 / F 6 3100-02
J1 / G 7 60616-01
J1 / H 8 31615-01
J1 / J 9 60706-01
J1 / K 10 60614-01
J1 / L 11 61000-02
J1 / M 31000-16 Ground shield
J1 / N 13 60613-01
J1 / O 14 60121-01
J1 / P 15 60810-01
J1 / Q 16 50000-02
J1 / R 17 50000-03
J1 / S 18 60120-01 Trim (Option)
J1 / T 12 61001-01 B+ / 24V
J1 / U 21 60901-03
J1 / V 22 60900-03
J1 / W 19 (no connection)
J1 / X 20 (no connection)
- Start
Batt +
Batt -
Sens ECU
Control ECU
61 +24V
Start
Charge
Illumination
Option
15
60 CAN
www.steyr-motors.com
2179339/D-02-070627_tedoc


WIRING DIAGRAM / INSTR. PANEL - 4/6 CYL. - Solas - 12V (OPTION)
STEYRMOTORS
INNOVATION WITH LIGHTNESS
SCC
X 24
Warning Horn H22
Lighting RPM-Gauge E12
RPM-Gauge P3
Lighting Opt. Gauge Oil-Pressure E11
Opt. Gauge Oil-Pressure P2
Opt. Key Switch-Constant Revolution S7
Lighting ECT-Gauge E10
Engine Coolant Temperature Gauge P1
OIL-Preheating control Lamp L3
Check Engine Lamp L2
Charge Control Lamp L1
Emergency CUT OFF Switch S3
START (green) S2
IGN (red) ON/OFF S1
Fuse 10A F9
Connector Illumination X8 switch
58000-01
Z1
Z2
Z3
Z4
No./colours of shielded wire correspond to individual cable No. (15000-01)
J1
J1 / A 1 15000-01
J1 / B 2 15000-02
J1 / C 3 30012-07
J1 / D 4 30012-08
J1 / E 5 31000-01
J1 / F 6 3100-02
J1 / G 7 60616-01
J1 / H 8 31615-01
J1 / J 9 60706-01
J1 / K 10 60614-01
J1 / L 11 61000-02
J1 / M 31000-16 Ground shield
J1 / N 13 60613-01
J1 / O 14 60121-01
J1 / P 15 60810-01
J1 / Q 16 50000-02
J1 / R 17 50000-03
J1 / S 18 60120-01 Trim (Option)
J1 / T 12 61001-01 B+ / 24V Optional 24 V
J1 / U 21 60901-03
J1 / V 22 60900-03
J1 / W 19 ohne Anschlag (no connection)
J1 / X 20 ohne Anschlag (no connection)
- Start
Batt +
Batt -
Sens ECU
Control ECU
61 +24V
Start
Charge
Illumination
Option
15
60 CAN
www.steyr-motors.com
2179340/D-02-070627_tedoc


WIRING DIAGRAM / INSTR. PANEL - 4/6 CYL. - Solas - 24V (OPTION)
STEYRMOTORS
INNOVATION WITH LIGHTNESS
SCC
X 24
Warning Horn H22
Lighting RPM-Gauge E12
RPM-Gauge P3
Lighting Opt. Gauge Oil-Pressure E11
Opt. Gauge Oil-Pressure P2
Opt. Key Switch-Constant Revolution S7
Lighting ECT-Gauge E10
Engine Coolant Temperature Gauge P1
OIL-Preheating control Lamp L3
Check Engine Lamp L2
Intermediate Cable Charge Indicator 24 V
Charge Control Lamp L1
Emergency CUT OFF Switch S3
START (green) S2
IGN (red) ON/OFF S1
Fuse 10A F9
Connector Illumination X8 switch
58000-01
Z1
Z2
Z3
Z4
- Start
No./colours of shielded wire correspond to individual cable No. (15000-01)
J1
J1 / A 1 15000-01
J1 / B 2 15000-02
J1 / C 3 30012-07
J1 / D 4 30012-08
J1 / E 5 31000-01
J1 / F 6 3100-02
J1 / G 7 60616-01
J1 / H 8 31615-01
J1 / J 9 60706-01
J1 / K 10 60614-01
J1 / L 11 61000-02
J1 / M 31000-16 Ground shield
J1 / N 13 60613-01
J1 / O 14 60121-01
J1 / P 15 60810-01
J1 / Q 16 50000-02
J1 / R 17 50000-03
J1 / S 18 60120-01 Trim (Option)
J1 / T 12 61001-01 B+ / 24V
J1 / U 21 60901-03
J1 / V 22 60900-03
J1 / W 19 (no connection)
J1 / X 20 (no connection)
Batt +
Batt -
Sens ECU
Control ECU
61 +24V
Start
Charge
Illumination
Option
15
60 CAN
2179341/D-03-070627-tedoc
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06. 07. 13 ADJUST INSTRUMENTS

06. 07. 13. 01 Tachometer with running-time meter

There are 2 possible settings

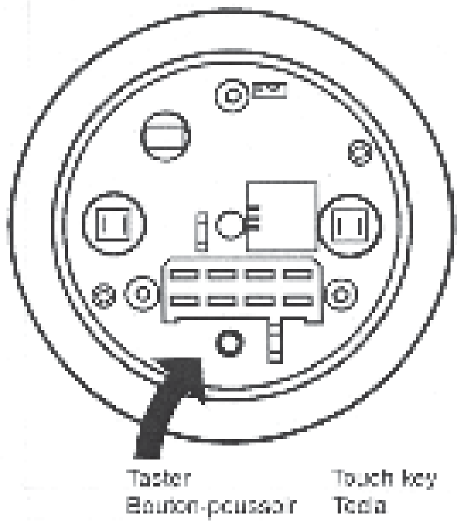
Function "PULSE": - Entry of pulse rate
12,18 per revolution
- inductive sender

Function "ADJUST": - Using a reference rpm meter (manual rpm meter), the rpm is compared and calibrated accordingly.



07.13 ill.1

Selection of function
Operating voltage off.
Press and hold down key on back of housing.
Operating voltage (ignition) on.
The display shows "PULSE" and "ADJUST" every 2 seconds in alternation.
To select shown function, release the key for respective indication.



07.13 ill.2

Function "PULSE"

When the function PULSE is selected, "P12.18" (12.18 pulses per revolution) appears for example on the display after approx. 3 seconds, with a flashing last digit. Immediately start entry of known pulse rate by repeated pressing of key.

The flashing digit may be adjusted by activating the key (possible pulse settings: 0.50 to 399.99).
After having adjusted the flashing digit, wait for approx. 3 sec. Then the next digit begins to flash. At completion of pulse rate setting, activate the key no more.
The display then changes over to counting of running-time. Thus the setting procedure is completed.

By repeated selection of function PULSE the selected pulse rate may be checked. The pulse rate appears on the display and the individual digits begin to flash in sequence, starting with the last digit.



07.13 ill.3

P-12,18

Function "ADJUSt"

When selecting the function "ADJUST", the rpm. display may be adjusted between 30 and 100 % of the measuring range.
Using a reference rpm meter (manual rpm meter), the rpm indicator is compared.

Fine adjustment requires two persons, one to operate the instrument and the other one to operate the manual rpm meter on the axis of the engine's crankshaft. Extreme caution is required! Do not wear loose clothing!

When the function ADJUSt is selected, UP or dn (UP or DOWN) appears in alternation on the display after approx. 3 seconds.
If, for example, the key is pressed and held down when UP is displayed, the pointer deflection changes upwards (for "dn" analogously downwards).
If you release the key for 2 seconds and then press it again, the pointer deflection changes downwards.
At the beginning, the pointer deflection changes very slowly which permits a very precise fine adjustment.
With a short release of the key, the procedure is repeated. With a longer pressing of the key, the pointer deflection will change faster. Release the key as soon as the fine adjustment corresponds to the reference rpm. The display then changes to counting of running-time. Fine adjustment is completed.





07.13 ill.4

Fine Adjustment:

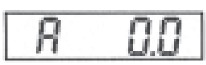
During normal operation of the indicator, a fine adjustment is possible by using the key. The adjustment range is +/- 20 % of the actual reading.
Press the key, with voltage supply on.
On the display appears A 0.0

By pressing and holding the key, the adjustment factor increases in steps of 0,5%.
If you release the key for 2 seconds and then press it again, the adjustment factor decreases in steps of 0,5%.

If the key is not pressed for more than 5 seconds, the adjustment factor will be stored and the indicator switches back to the normal running-time display.



07.13 ill.5



06. 07. 14 REPLACE INSTRUMENTS

06. 07. 14. 01. General notes on safety

Safety instructions

No smoking!
No open fire lights!
This product has been developed, produced and tested in compliance with the basic safety requirements of EC directives and in accordance with the established state of the art.
Use our product for the intended purpose only.
The consequences of use of the product for other than the intended purpose may be personal injury and damage to property as well as environmental damage.
The unit is designed for use in sports boats.
Record data of other instruments with transient electronic memories.

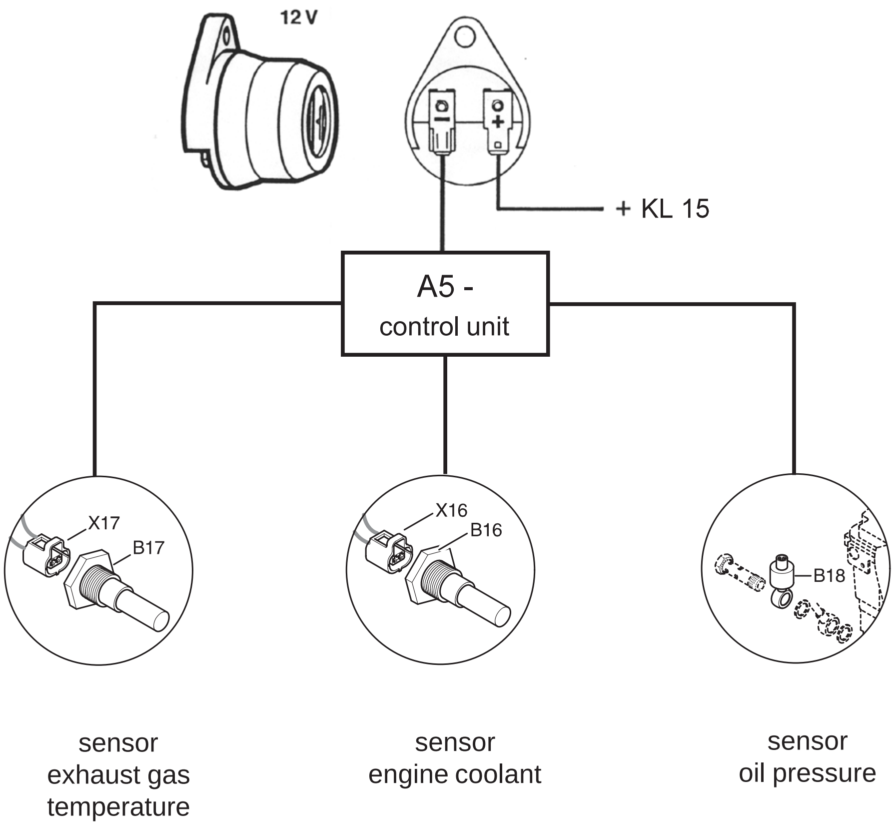
Please note during installation:
The product should be installed by your boatyard or by a person specialised in the installation of such devices.
If you wish to carry out installation yourself, wear suitable working clothing. Do not wear loose-fitting clothing. This may be caught by moving parts. If you have long hair, wear a hair net.
When working on electric equipment, do not wear any metallic or conductive jewellery such as chains, bracelets, rings etc.
Before beginning work, disconnect the negative pole of the battery, since otherwise there is a risk of a short ciruit. Short circuits can cause cable fires, battery explosions and damage to other electronic storage systems. Please note that when the battery is disconnected, all transient electronic memories lose the values entered and have to be reprogrammed.
With petrol engines, allow the engine compartment fan to run before beginning work in the engine compartment.
At the installation site, make sure there is sufficient space behind drilled holes or the installation aperture.
First drill small holes at the installation apertures, and enlarge if necessary using tapered drills, compass saws, fretsaws of files. Deburr edges.The safety instructions of the hand tool manufacturer must be observed.
If work has to be carried out without interruptions in voltage, only insulated tools may be used.
The electrical outputs of the display unit and the connected cables must be protected from direct contact and damage. To this end, the cables used must have adequate insulation and/or dielectric strenght, and the contacts must be shockproof.
The electrical conductive parts of the connected consumers must also be protected from direct contact by suitable means. The installation of bare metal cables and contacts is forbidden.

After installation, please note:
Clamp the earthing cable firmly to the negative pole of the battery.
Enter/program the values of the transient electronic memories again.
Test all functions.

Safety Instructions (electrical connection):

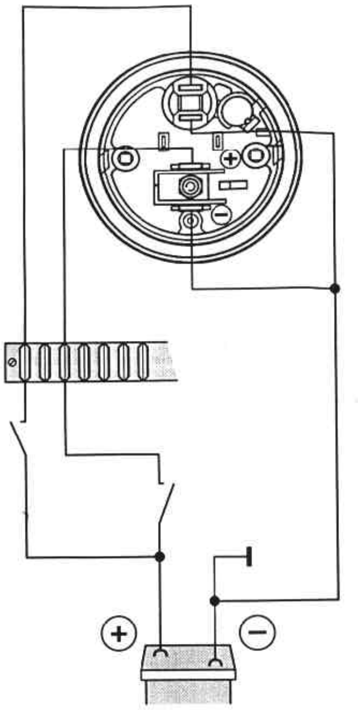
To install the electric cables, use existing cable ducts and looms, but do not run the cables paralle to ignition cables or parallel to cables leading powerful consumers. Secure the cables using cable binders or adhesive tape.
Do not run the cables over moving parts.
Ensure that the cables are not exposed to any tensile, compressive or shear forces.
If the cables have to be run through drilled holes, protect the cables using grommets or rubber bushings etc.
Use only a cable stripper to strip the cables. Adjust the cable stripper so that the individual strands are not damaged or cut off.
New connections should only be made using soft solder, or with commercial crimp connectors.
Crimped connections should only be made using cable crimping pliers. The safety instructions of the hand tool manufacturer must be observed. Insulate exposed leads in such a way that short circuits cannot occur.
Caution: Risk of short circuit through faulty junctions or damaged cables.
Short circuits in the electrical system can cause cable fires, battery explosions and damage to other electronic systems. For this reason, all connections in the voltage supply system must be either soldered or fitted with weldable connectors and adequately insulated.
Pay particular attention to correct earth connections.
Incorrect connections can lead to short circuits. The cables must only be connected in accordance with the electrical terminal connection diagram.

06. 07. 14. 02 Audible warner, H22



07.14 ill.1

06. 07. 14. 03 Circuit diagram voltmeter (optional)

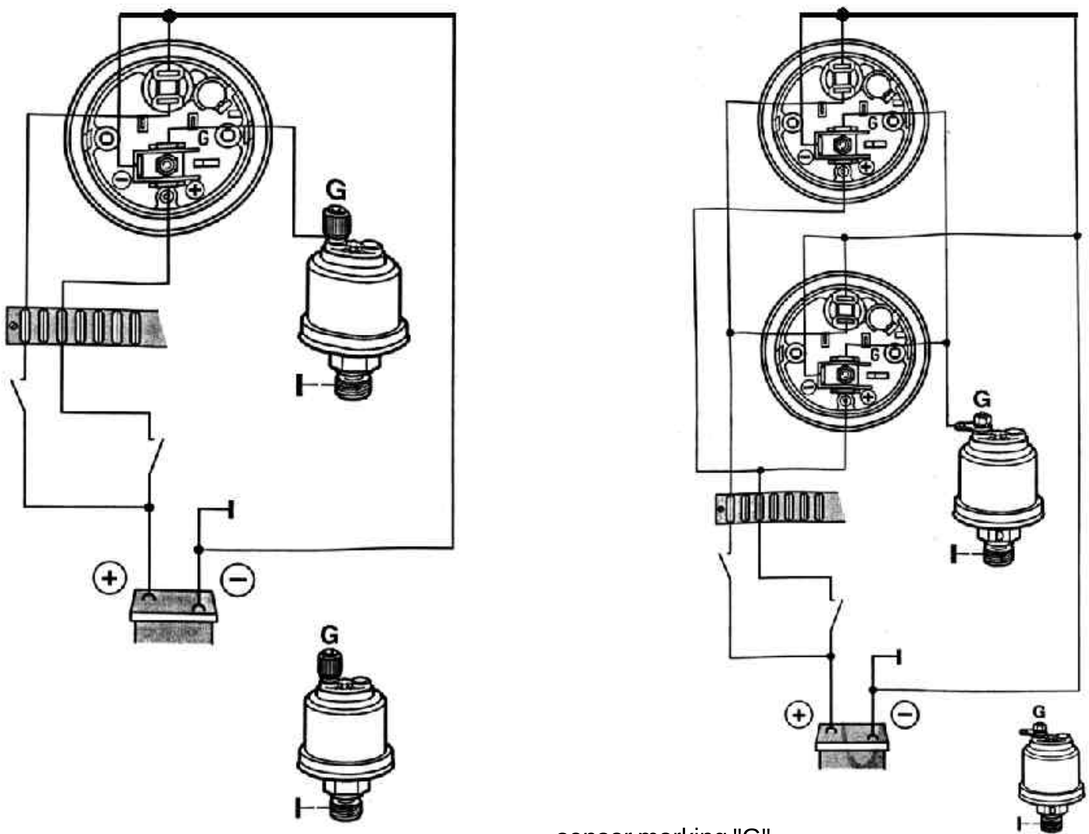


07.14 ill.2

06. 07. 14. 04 Circuit diagram oil pressure gauge (optional, sensor B19 - gauge P2)

single instruments

double instruments (requires special sensor)



sensor marking "G"
one sensor for two displays

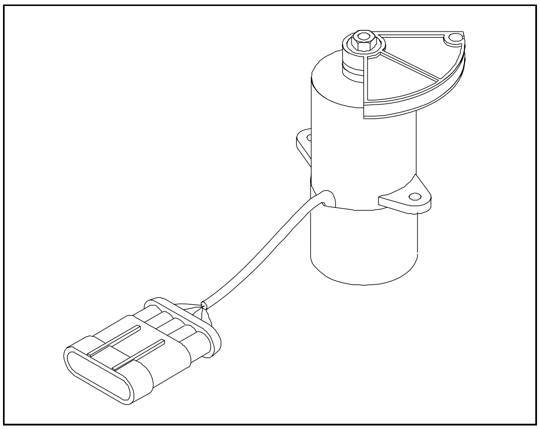
07.14 ill.3

06.08.01 Potentiometer Accelerator, B13

1 Remove plug housing.

2 Unscrew hexagon nut of accelerator lever, remove lever.

3 Loosen 2 hexagon screws. Remove accelerator.



08.01 ill.1

Throttle potentiometer B13 (accelerator) (= connector X13)
In case of defective potentiometer accelerator B13, service codes 23, 24 or 29 will flash.

NOTE: First check cables and connections.



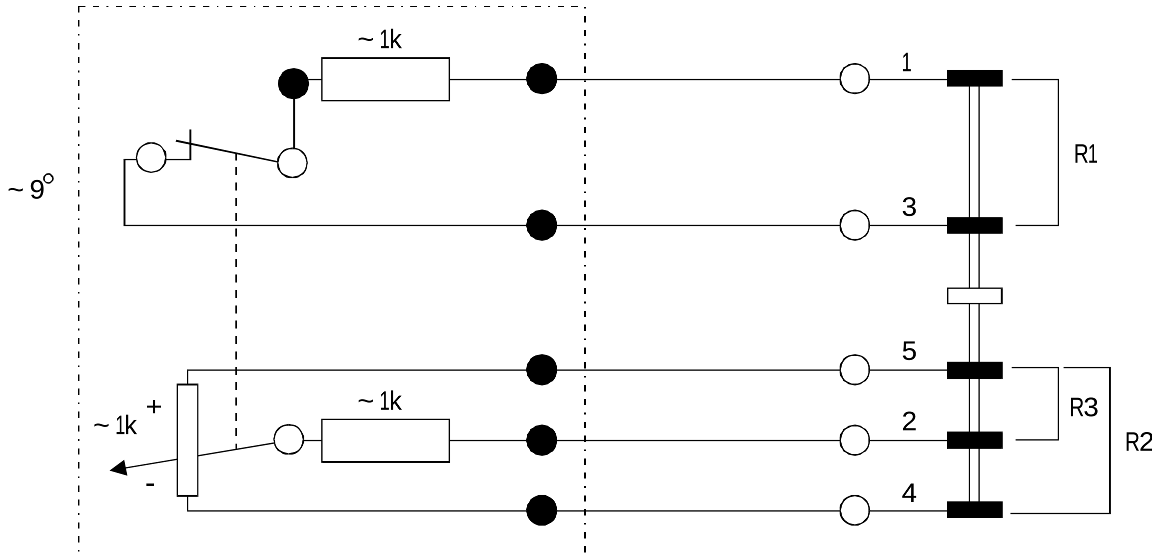
08.01 ill.2

R1 Resistance between terminals 3 and 1; approximately 1,2 kOhm resistance value switch to infinetely after moving throttle lever from idle position. Switch contact should open within the first 10% of throttle lever (pedal) movement.

R2 Resistance between terminals 5 and 4; 1,2 kOhm

R3 Resistance between terminals 5 and 2; 2,2 kOhm for normal position of potentiometer accelerator ; 1,4 kOhm at "full speed " max. throttle position.

Wiring Circuit - Potentiometer P/N 2176860/0

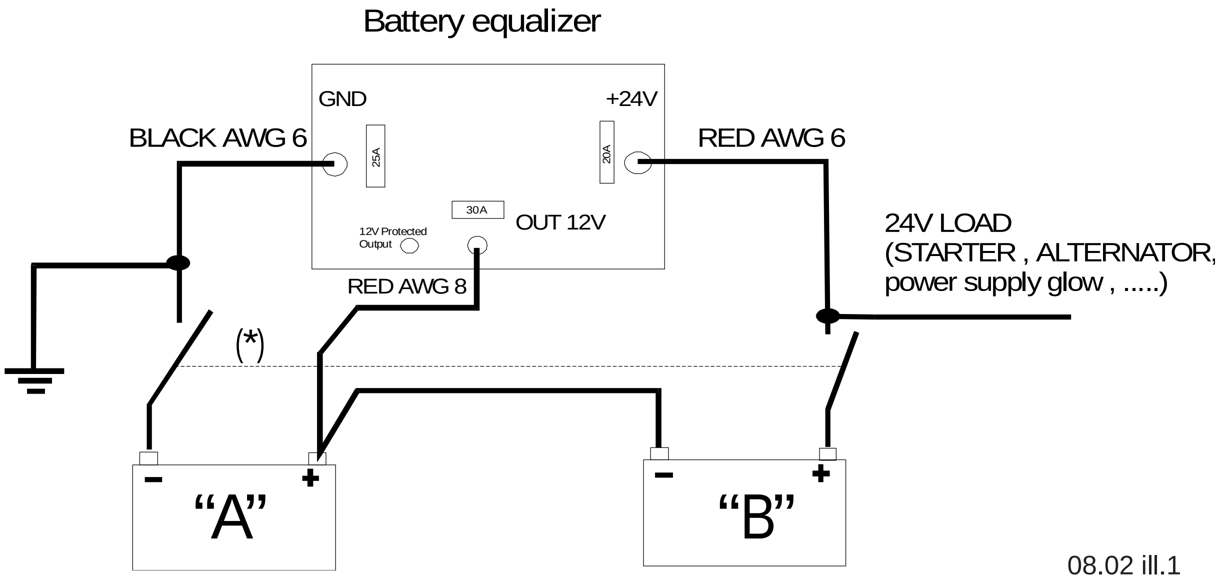


08.01 ill.3

06.08.02 Voltage regulator 24V-12V equalizer

Powersupply to equalizer recomandet wire gauge size.

Starter must be connecting by customer use a wire min. AWG 0 (50 mm²)
connect a red wire AWG 8 (6 mm²) at battery "A" positiv terminal +12V
connect a red wire AWG 6 (10 mm²) at battery "B" positiv terminal +24V
connect a black wire AWG 6 (10 mm²) directly at battery "A" negativ terminal.



08.02 ill.1

*** Note:**......Mainswitsches are mechanically interlinked.

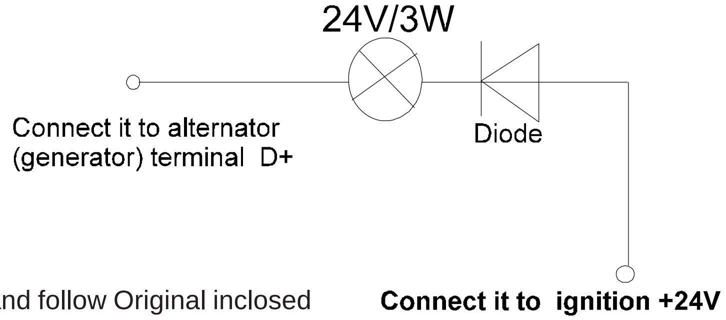
X21 ARMATUREN PLUG 6-POLE: --> USE ONLY 12 VOLT INSTRUMENTS

pin1 60810--> check engine lampe (12V/2W)
pin2 60616--> glow lamp (12V/2W)
pin3 60614--> temperature instruments (12V)
pin4 60613--> engine speed instruments (12V)
pin5 50000--> starter terminal 50 (detection of start)
pin6 15000--> ignition connect it to the ignition-switch of the vehicle (protect with 5 Amp fuse)

Note: The glow lamp has 2 functions --> at first it works as glow lamp after start it works as oil pressure lamp.

ALTERNATOR

B+ must be connection by customer --> use a wire AWG 6 (10 mm²) charging control --> must be connecting by customer.



08.02 ill.2

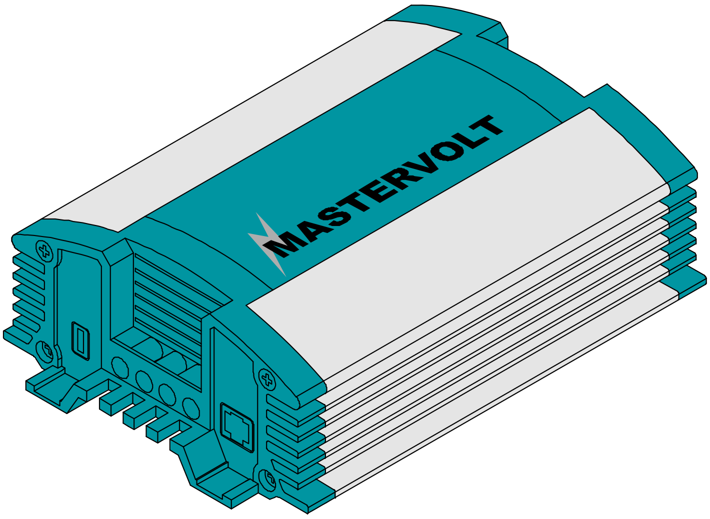
ATTENTION:

Please observer and follow Original inclosed manufactures recommentation!

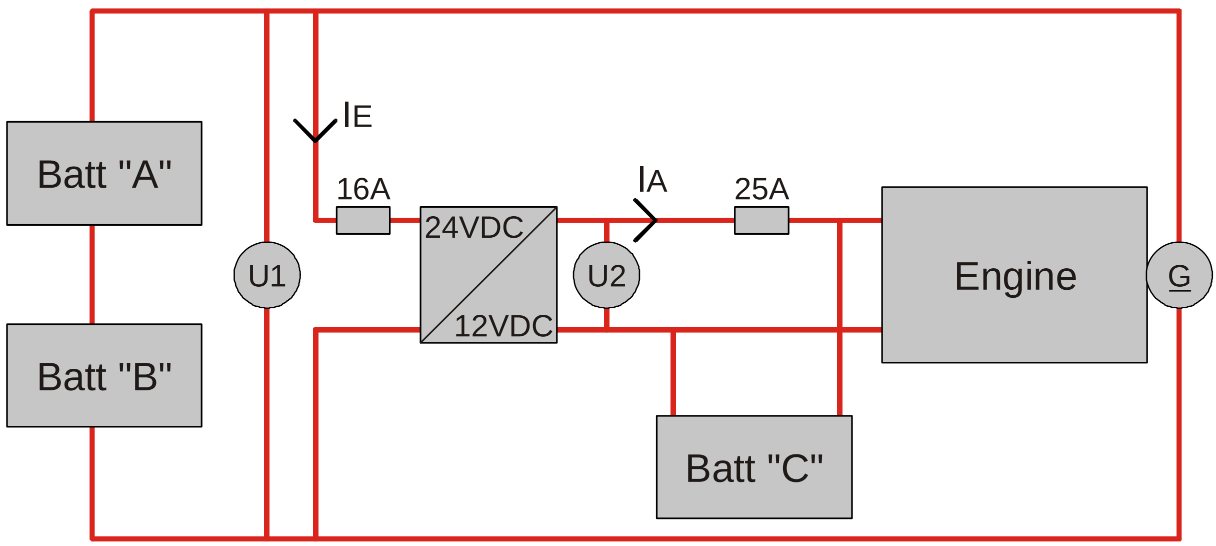
06.08.03 DC - DC converter

DC-DC Converter
IVO 8770

MASTERVOLT



CIRCUIT DIAGRAM

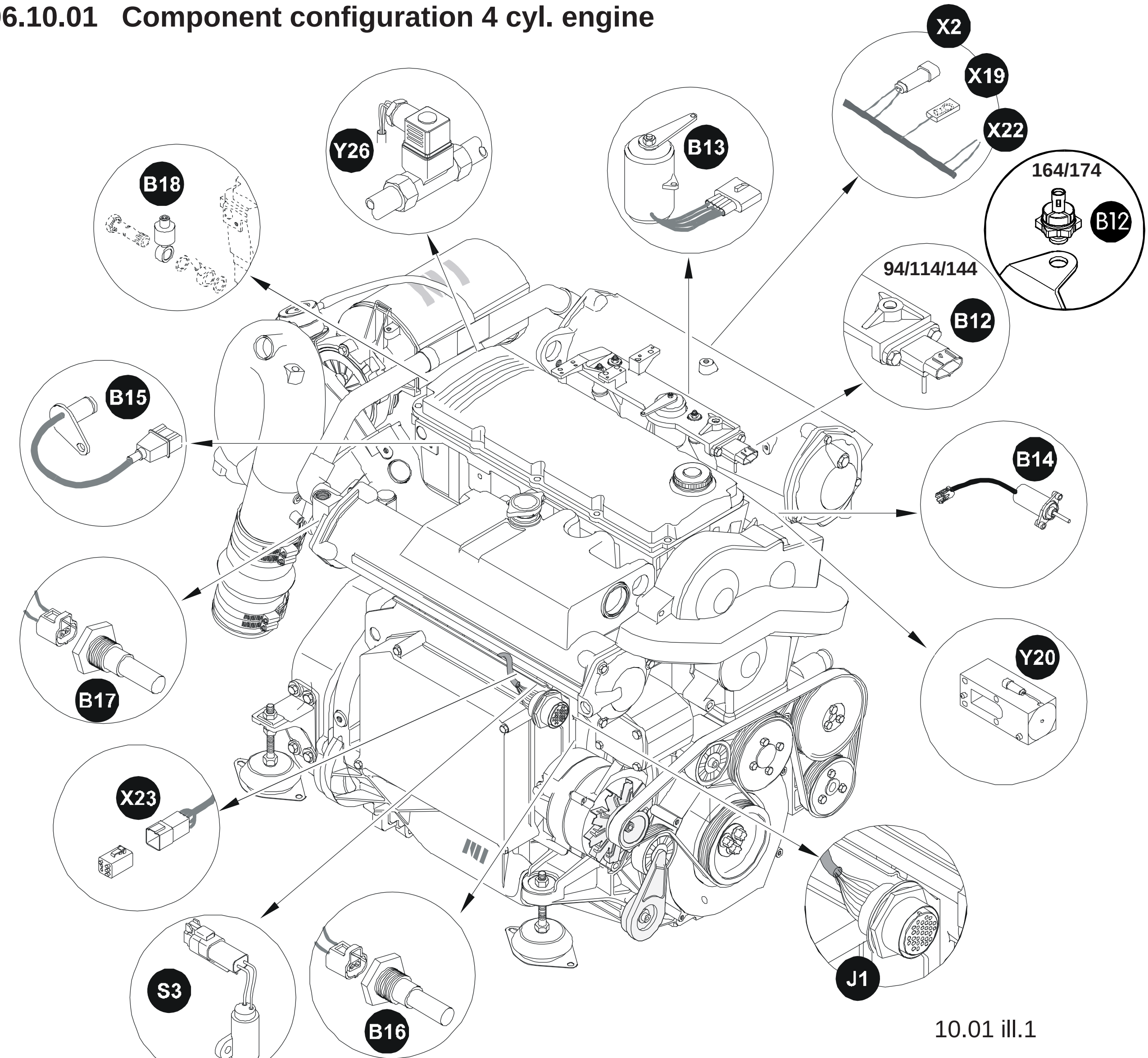


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06.10 SENDER AND SENSOR OVERVIEW

to engine number 48226999

06.10.01 Component configuration 4 cyl. engine

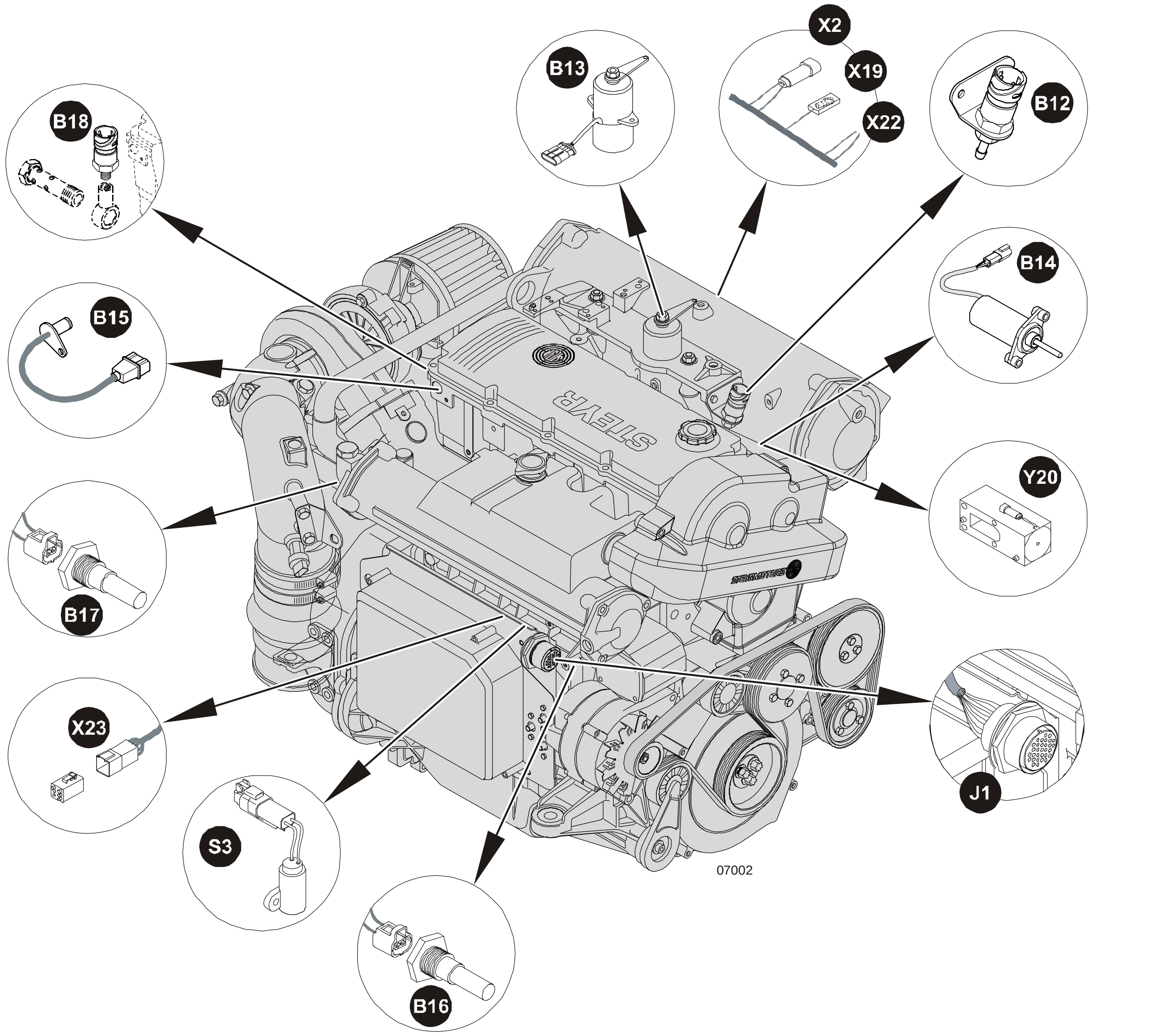


10.01 ill.1

CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
B12	MAP	Ladedrucksensor Boost-pressure sensor
B13	PED	Gaspedal Potentiometer accelerator
B14	RPOS	Regelstangensensor Rack position sensor
B15	RPM	Motordrehzahlsensor Sensor engine speed
B16	ECT	Kühlflüssigkeitstemperatursensor Sensor engine coolant temperature
B17	EXT	Abgastemperatursensor Sensor exhaust gas temperature
B18	LPS	Öldrucksensor Lubricant pressure sensor

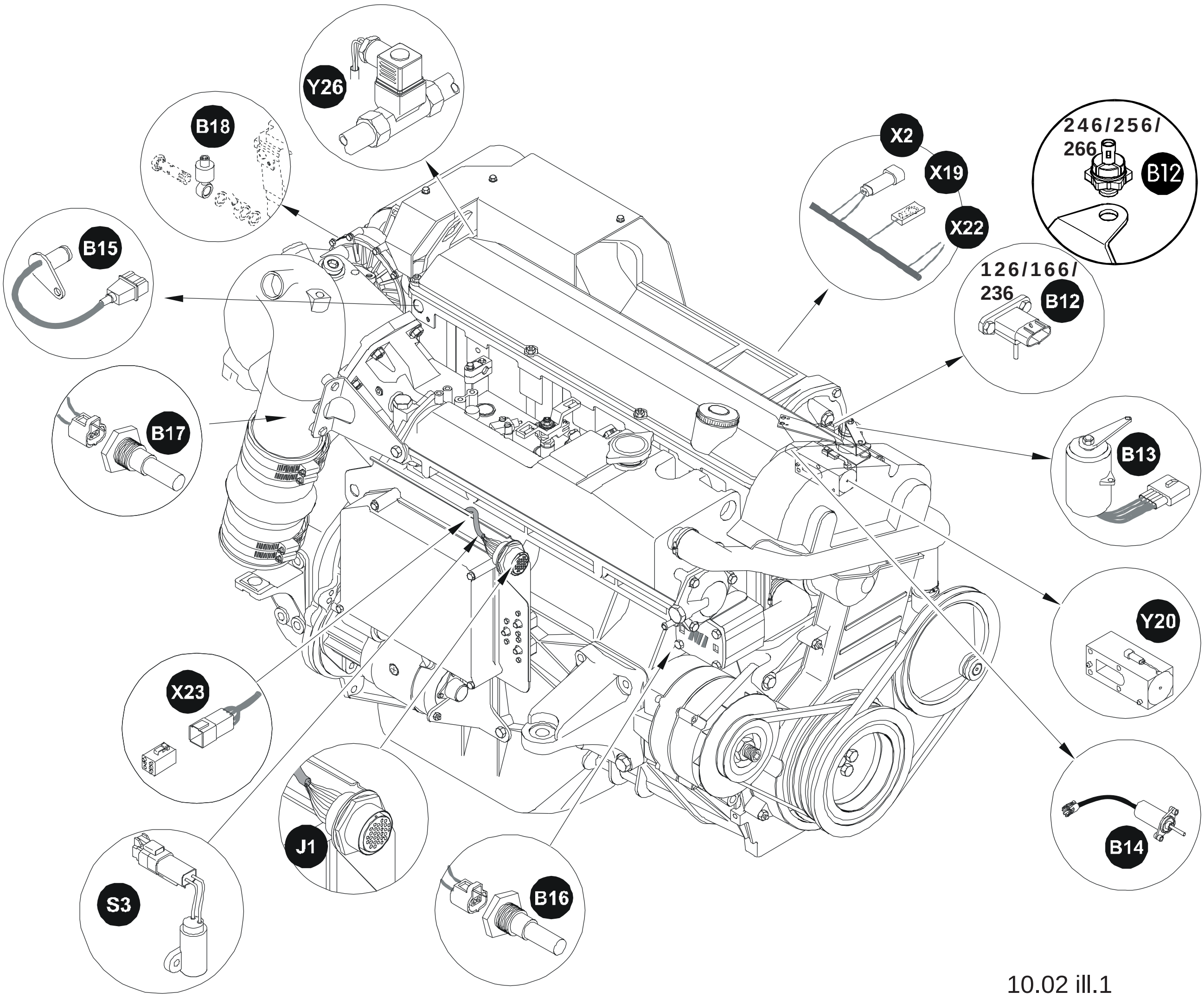
CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
X19		Stecker Ölmanometer (Option) Connector oil pressure gauge (optional)
X22		Stecker Trimmanzeige (Option) Connector trim (optional)
J1	J1	Verbindungsstecker Motor - EMS Connector engine cable - EMS
X23	DIAG	Diagnose - Stecker Diagnosis - plug
Y20	FMS	Steuermagnet Control solenoid
X2		Stecker Getriebeschalter (Option) Connector gear switch (optional)
S3		Inversionsschalter (Nur bei SOLAS) Inversion switch (only for SOLAS)
Y26		Abschaltventil (Nur bei SOLAS) Blow - by (only for SOLAS)

from engine number 48227000



CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION	CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
B12	MAP	Ladedrucksensor Boost-pressure sensor	X19		Stecker Ölmanometer (Option) Connector oil pressure gauge (optional)
B13	CMD	Gaspedal Potentiometer accelerator	X22		Stecker Trimmanzeige (Option) Connector trim (optional)
B14	RACK	Regelstangensensor Rack position sensor	J1	J1	Haupt-Verbindungsstecker Main connector
B15	RPM	Motordrehzahlsensor Sensor engine speed	X23	DIAG	Diagnose - Stecker Diagnosis - plug
B16	ECT	Kühlflüssigkeittemperatursensor Sensor engine coolant temperature	Y20	FMS	Steuermagnet Control solenoid
B17	EXT	Abgastemperatursensor Sensor exhaust gas temperature	X2		Stecker Getriebeschalter (Option) Connector gear switch (optional)
B18	LPS	Öldrucksensor Lubricant pressure sensor	S3		Inversionsschalter (nur bei SOLAS) Inversion switch (only for SOLAS)

06.10.02 Component configuration 6 cyl. engine to engine number 68226999

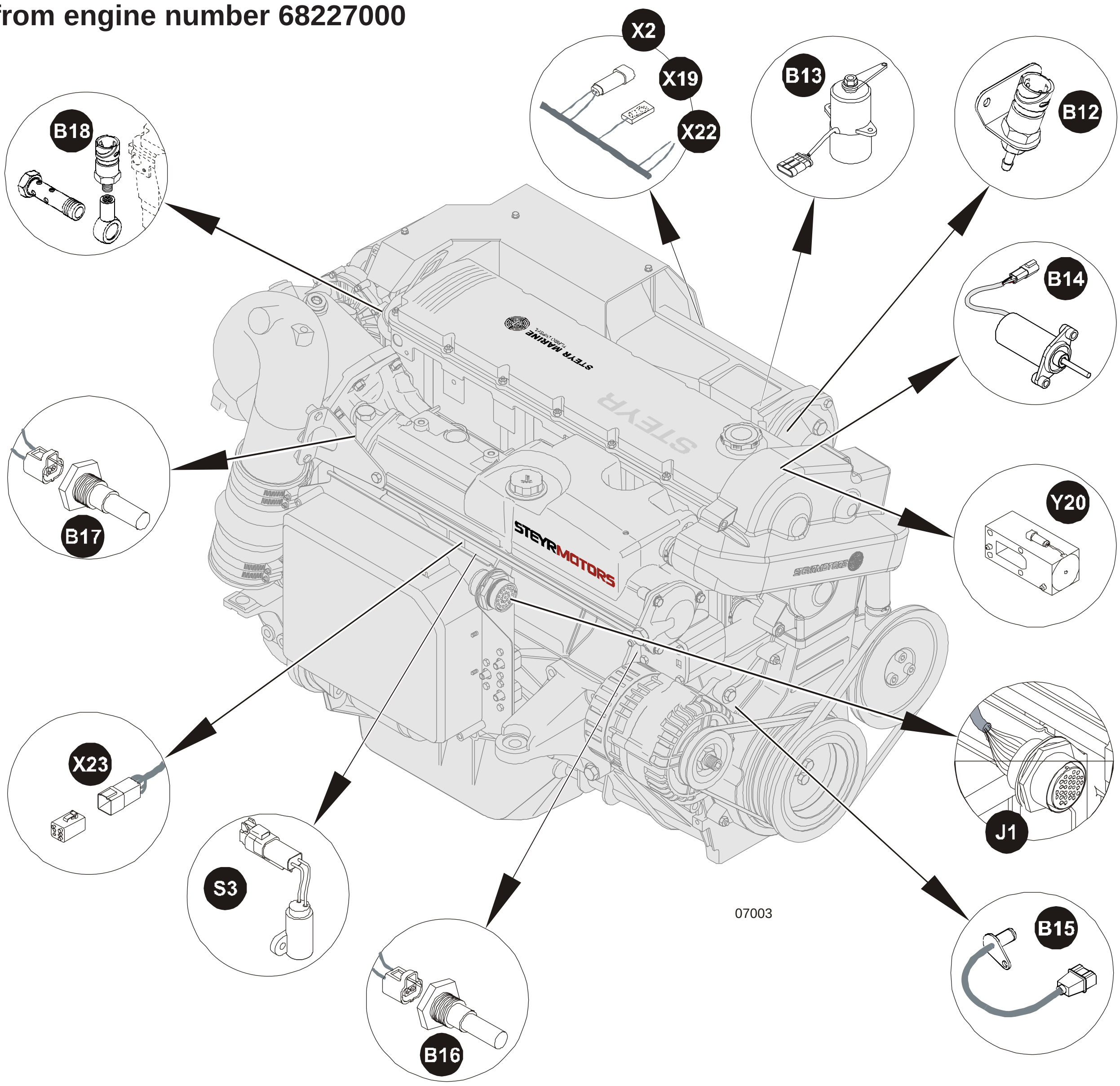


10.02 ill.1

CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
B12	MAP	Ladedrucksensor Boost-pressure sensor
B13	PED	Gaspedal Potentiometer accelerator
B14	RPOS	Regelstangensensor Rack position sensor
B15	RPM	Motordrehzahlsensor Sensor engine speed
B16	ECT	Kühlflüssigkeitstemperatursensor Sensor engine coolant temperature
B17	EXT	Abgastemperatursensor Sensor exhaust gas temperature
B18	LPS	Öldrucksensor Lubricant pressure sensor

CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
X19		Stecker Ölmanometer (Option) Connector oil pressure gauge (optional)
X22		Stecker Trimmanzeige (Option) Connector trim (optional)
J1	J1	Verbindungsstecker Motor - EMS Connector engine cable - EMS
X23	DIAG	Diagnose - Stecker Diagnosis - plug
Y20	FMS	Steuermagnet Control solenoid
X2		Stecker Getriebeschalter (Option) Connector gear switch (optional)
S3		Inversionsschalter (Nur bei SOLAS) Inversion switch (only for SOLAS)
Y26		Abschaltventil (Nur bei SOLAS) Blow - by (only for SOLAS)

from engine number 68227000

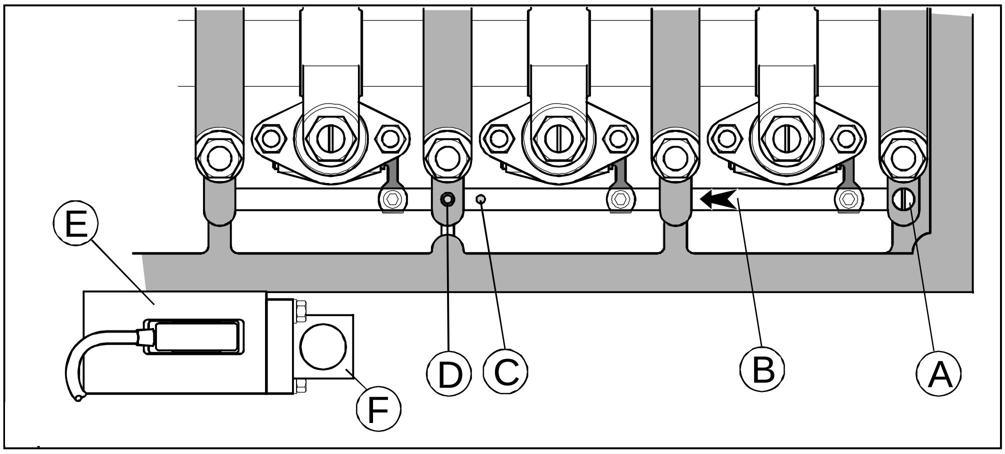


CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION	CODE	KURZNAME ABBREVIATION	BESCHREIBUNG DESCRIPTION
B12	MAP	Ladedrucksensor Boost-pressure sensor	X19		Stecker Ölmanometer (Option) Connector oil pressure gauge (optional)
B13	CMD	Gaspedal Potentiometer accelerator	X22		Stecker Trimmanzeige (Option) Connector trim (optional)
B14	RACK	Regelstangensensor Rack position sensor	J1	J1	Haupt-Verbindungsstecker Main connector
B15	RPM	Motordrehzahlsensor Sensor engine speed	X23	DIAG	Diagnose - Stecker Diagnosis - plug
B16	ECT	Kühlflüssigkeittemperatursensor Sensor engine coolant temperature	Y20	FMS	Steuermagnet Control solenoid
B17	EXT	Abgastemperatursensor Sensor exhaust gas temperature	X2		Stecker Getriebeschalter (Option) Connector gear switch (optional)
B18	LPS	Öldrucksensor Lubricant pressure sensor	S3		Inversionsschalter (nur bei SOLAS) Inversion switch (only for SOLAS)

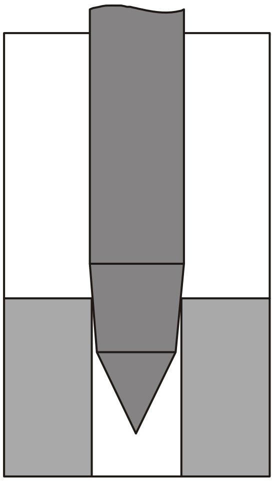
06.10.03 Calibration of rack position

This procedure must be carried out if any of the following has been done:

- Control solenoid has been disassembled or replaced, refer to 03. 08. 01.
- Rack position sensor has been disassembled or replaced, refer to 03. 08. 03.
- Engine control unit has been replaced.
- Rack or linkage lever have been replaced or loosened.



10.03 ill.1



10.03 ill.2

NOTE: Ensure that the ignition is turned off.

1 Remove threaded pin from position A (ill. 1).

2 Manually move rack (ill.1/B) forward until borehole (ill.1/C) is over tapped hole (ill.1/D) and fix with threaded pin. The pin must be fastened hand tight and sit correctly in the rack, see ill. 2. above.

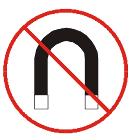
3 Turn on ignition,rack position will be automatically stored in the ECU A5. Storage process will take approx. 20 sec.

4 Turn off ignition.

5 Loosen threaded pin and screw it into rear bulkhead wall (ill.1/A).

NOTE: If storage in ECU A5 was unsuccessful, error code 56 will be detected. Refer to Error Codes.

NOTE:



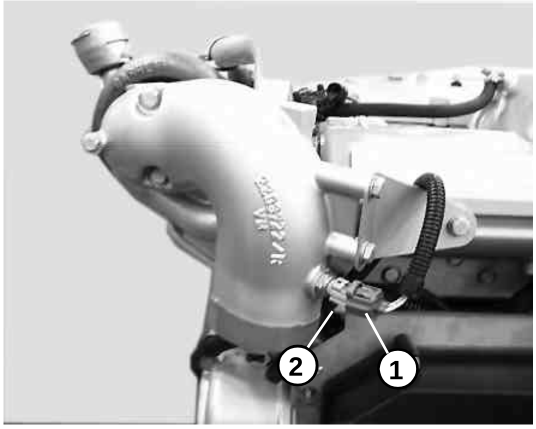
The rack position sensor is magnetism sensitive. All external magnets must be kept away as the may disturb the sensor.

06.10.04 Replace Senders, Sensors

06.10.04.01 Exhaust gas temperature sensor, B17

1 Unlock plug (ill.1/pos.1) and remove.

2 Unscrew temperature sensor (ill.1/pos.2) (SW19)

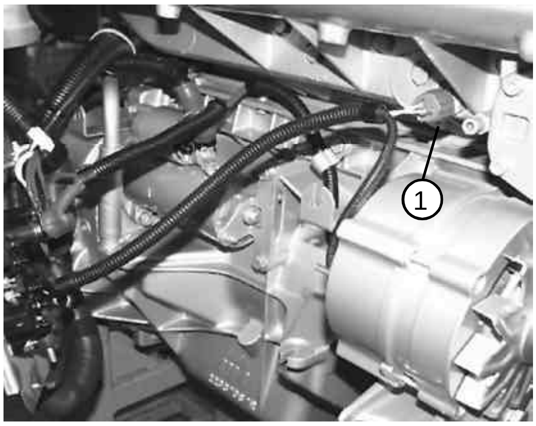


10.04 ill.1

06.10.04.02 Engine temperature sensor, B16

1 Remove plug housing (ill.2/pos.1).

2 Unscrew engine temperature sensor.



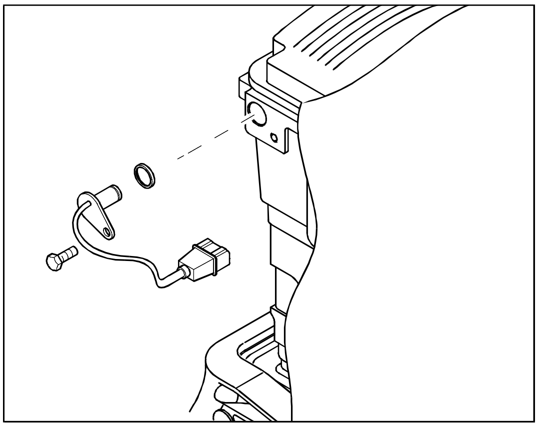
10.04 ill.2

06.10.04.03 Speed sensor, B15

1 Press catch spring and remove plug.

2 Loosen hexagon screw (SW10), pull out sensor.

ATTENTION: For assembly, use new 0-ring. Grease O-ring and put it on.


10.04 ill.3

06.10.04.04 Boost pressure sensor, B12 for engines 94 / 114 / 144 / 126 / 166 / 236 only

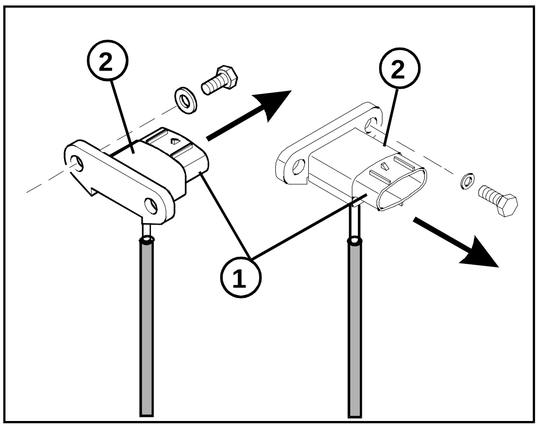
1 Remove hose from exhaust manifold.

ATTENTION: Do not remove hose from boost pressure sensor.

2 Press retaining clip against plug housing (ill.4/pos.1), remove plug.

3 Loosen two hexagon screws (SW10), remove boost pressure sensor (ill.4/pos.2).

NOTE: For assembly, take care of the 2 sealing cushions of plug housing.



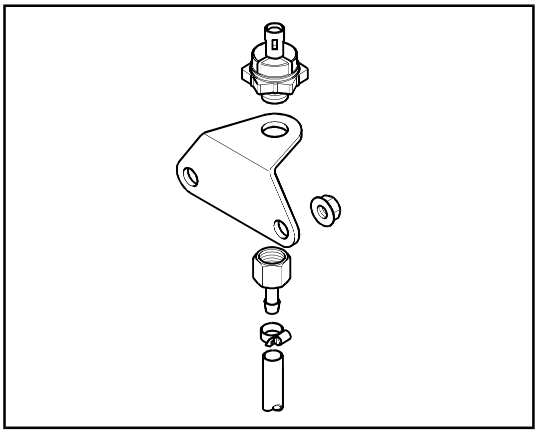
10.04 ill.4

Boost pressure sensor, B12
for engines 164 / 174 / 246 / 256 / 266 only

1 Remove cable strap, lift shackle at plug and pull off plug.

2 Loosen clamp (SW6) and pull off hose.

3 Loosen union nut (SW17) by holding up at sensor (SW32). Remove sensor
Assembly is done in reverse order off disassembly.
NOTE: Wetten the thread from the new sensor with **LOCTITE 243**. Thigthen union nut solid.



10.04 ill.5

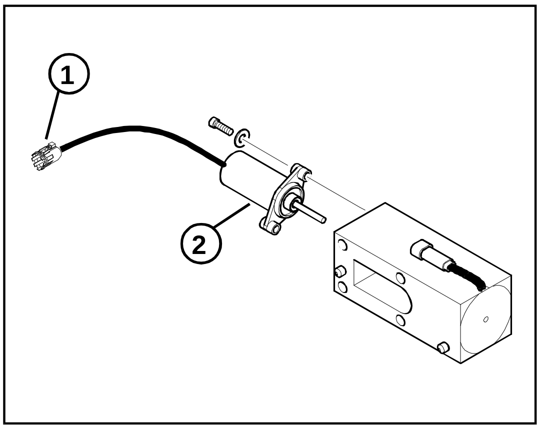
06.10.04.05 Rack position feedback sensor, B14

1 Remove retaining clip, remove plug housing (ill.6/pos.1).

2 Disassemble control solenoid, refer to 03.08.01

3 Loosen 2 cylinder screws with hexagon socket (SW 3), remove sensor (ill.6/pos.2).

Assembly is done according to assembly of control solenoid, refer to 03.08.



10.04 ill.6

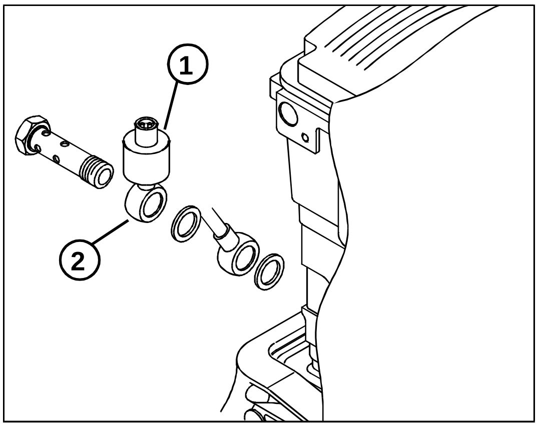
06.10.04.06 Oil pressure sensor, B18

1 Remove plug housing.

2 Unscrew oil pressure sensor (ill.7/pos.1) from mount (ill.7/pos.2).

ATTENTION: Collect running out motor oil in a suitable vessel.





10.04 ill.7

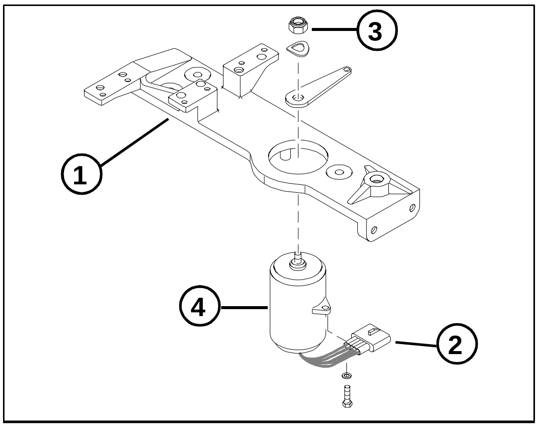
06.10.04.07 Potentiometer Accelerator, B13

1 Disassemble indexing plate (ill.8+9/pos.1).

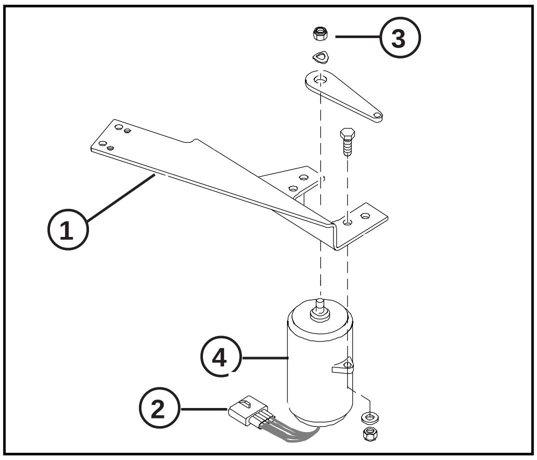
2 Remove plug housing (ill.8+9/pos.2).

3 Unscrew hexagon nut of accelerator lever (ill.8+9/ pos.3), remove lever.

4 Loosen 2 hexagon screws. Remove accelerator (ill.8+9/pos.4).



10.04 ill.8



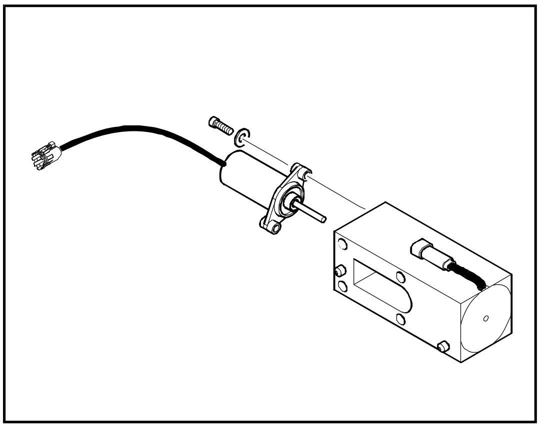
10.04 ill. 9

06.10.05 Check Sensors and Switches

06.10.05.01 A Check rack position feedback sensor B14 (= connector X14)

In case of defective rack position feedback sensor B14, service codes (35) and (36) will flash.

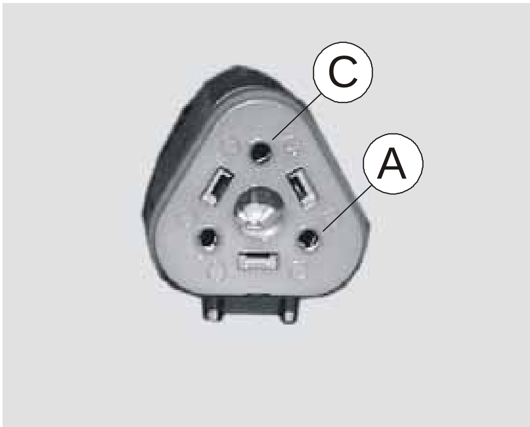
NOTE: First always check cables and connections.



10.05 A ill.1

Final check:

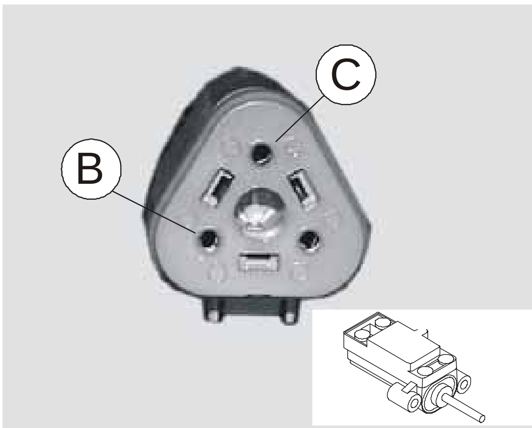
Disassemble rack position feedback sensor from control solenoid.



10.05 A ill.2

1 Check resistance between terminals A and C with a digital ohmmeter. Resistance must be between 2,2 kOhm ± 10 %.

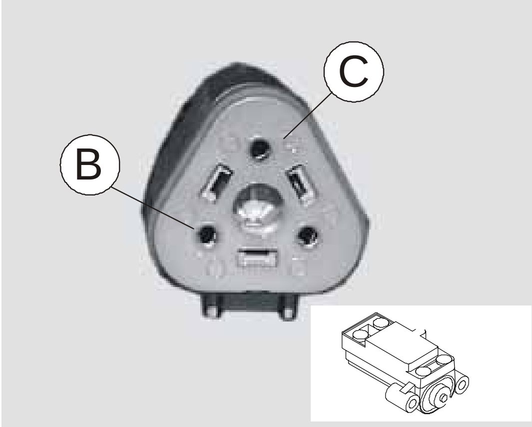
2 Measure resistance between terminals B and C with extended shaft. Resistance must be 0,5 kOhm ± 10 %.



10.05 A ill.3

3 Measure resistance between terminals B and C with inserted shaft. Resistance must be 2,4 kOhm ± 10 %.

When a failure was found during one of above checks, replace rack position feedback sensor B14.

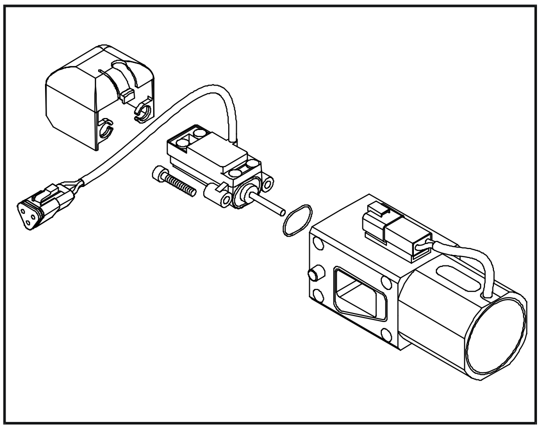


10.05 A ill.4

06.10.05.01 B Check rack position feedback sensor B14 (= connector X14)

In case of defective rack position feedback sensor B14, service codes 35 and 36 or 186 will flash.

NOTE: First always check cables and connections.

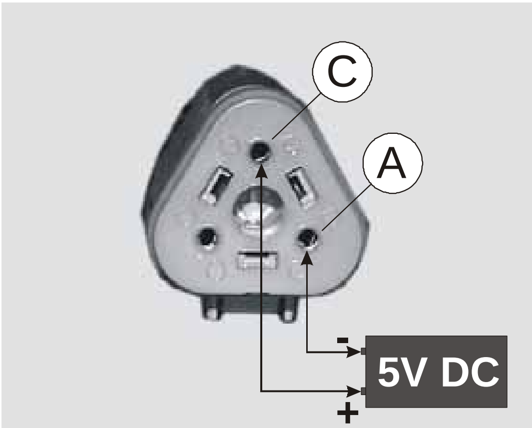


10.05 B ill.1

Final check:

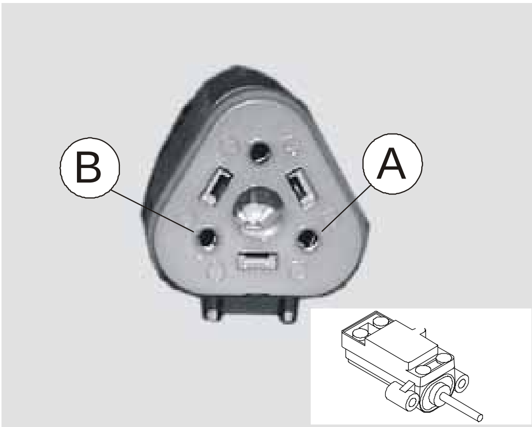
Disassemble rack position feedback sensor from control solenoid.

1 Supply terminals A ("-"; minus) and C ("+"; plus) with 5,0V DC +/- 1%.



10.05 B ill.2

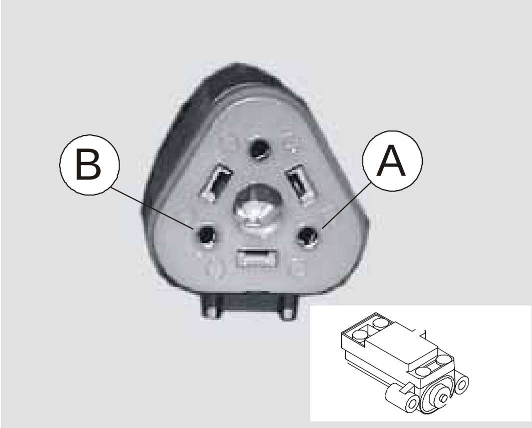
2 Sensor extended!
Measure between terminal A (minus) and B (signal out). Measured voltage must be 4,8V DC +/- 5%.



10.05 B ill.3

3 Sensor retracted!
Measure between terminal A (minus) and B (signal out). Measured votage must be 0,12V DC +/- 5%.

When a failure was found during one of above checks, replace rack position feedback sensor B14.

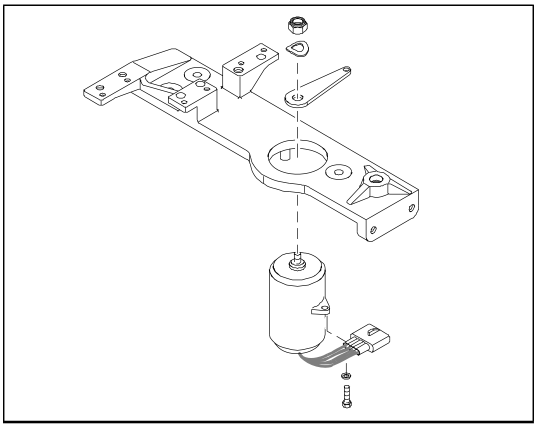


10.05 B ill.4

06.10.05.02 Check throttle potentiometer B13 (accelerator) (= connector X13)

In case of defective potentiometer accelerator B13, service codes 23, 24 or 29 will flash.

NOTE: First check cables and connections.



10.05 ill.5

* Resistance between terminals 5 and 4; 1,2 kOhm

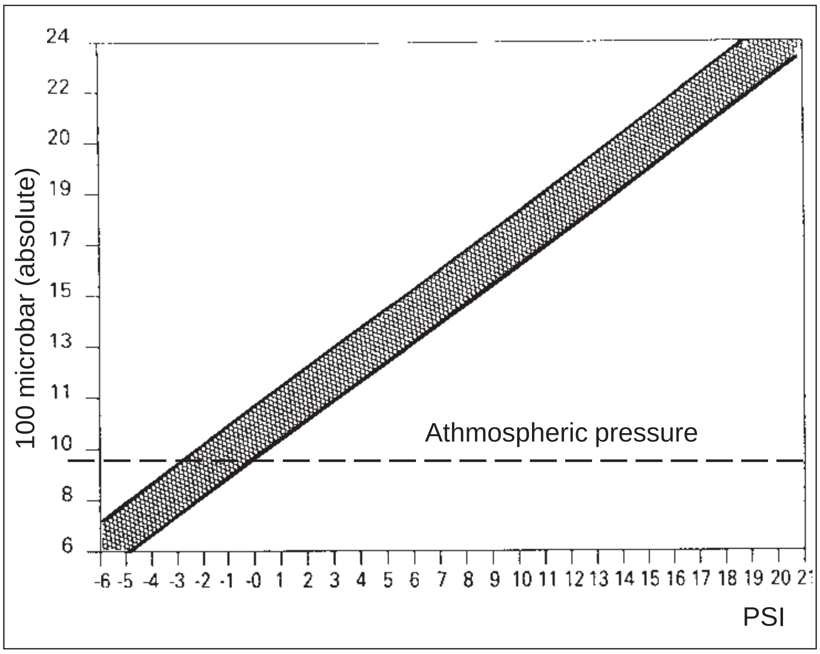
* Resistance between terminals 5 and 2; 2,2 kOhm for normal position of potentiometer accelerator ; 1,4 kOhm at "full speed " max. impact.

* Resistance between terminals 3 and 1; 1,2 kOhm With approx. 10% of max. first route, resistance value must increase infinetely high ==> (disconnection).



10.05 ill.6

06.10.05.03 Check boost pressure sensor, B12, for engine models: 94 / 114 / 144 / 126 / 166 / 236



10.05 ill.7

For engine models: 164 / 174 / 246 / 256 / 266

Output - voltage (Volt)

Supply voltage
5V +/- 0,2V

Connector position
A = +5V
B = GND
C = Signal

Max. pressure with
3 bar (3,5 absolut)

10.05 ill.8 Absolut - air pressure (bar)

NOTE: Before checking the boost pressure sensor, check air filter, sensor hose and connector.

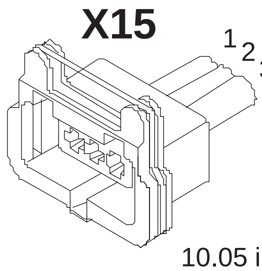
Pressure test:
For a pressure test of the sensor, disconnect the sensor hose and connect a pressure gauge with a short piece of hose to the sensor.

Carefully pressurize the sensor. Read and record the values on the gauge (input pressure) and on the display (output pressure) for 5 spots between 0 and 1.5 bar. Compare recorded input and output values with the chart.

- If values are not within tolerance limits, replace the boost pressure sensor.
- If values are within tolerance limits, the boost pressure sensor is functional and the turbocharger must be checked.

06.10.05.04 Check speed sensor B15 and/or wiring

X 15/1	**15012-06**
X15/2	**60113-01**
X15/3	**31000-03**



10.05 ill.9

On account of the sensor's integrated electronic system, only the supply voltage and/or the output signal and the continuity to control unit A5 can be measured.
Make sure that with disconnected plug X15 and ignition "ON" an error code can be stored
--> At completion of checking, cancel the error code; refer to 06.06.04

Use a standard voltmeter / multimeter to measure the supply voltage and/or the resistance.

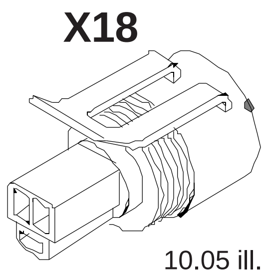
Supply voltage Ubat (12V +/- 2V)
ignition ON main relay K27 active
measurement point GND on X15/3 against +supply voltage on X15/1

Continuity from X15/2 to control unit X5/33
max. resistance 2 ohms

If supply voltage and transition from X15/2 to X5/33 are connect, replace the speed sensor.
In case an error was detected during preceding measurements, check wiring according to circuit diagram and wiring harness diagram.

06.10.05.05 Check oil pressure sensor B18 and/or wiring

X18/A	**31100-10**
X18/B	**15100-07**
X18/C	**60117-01**



10.05 ill.10

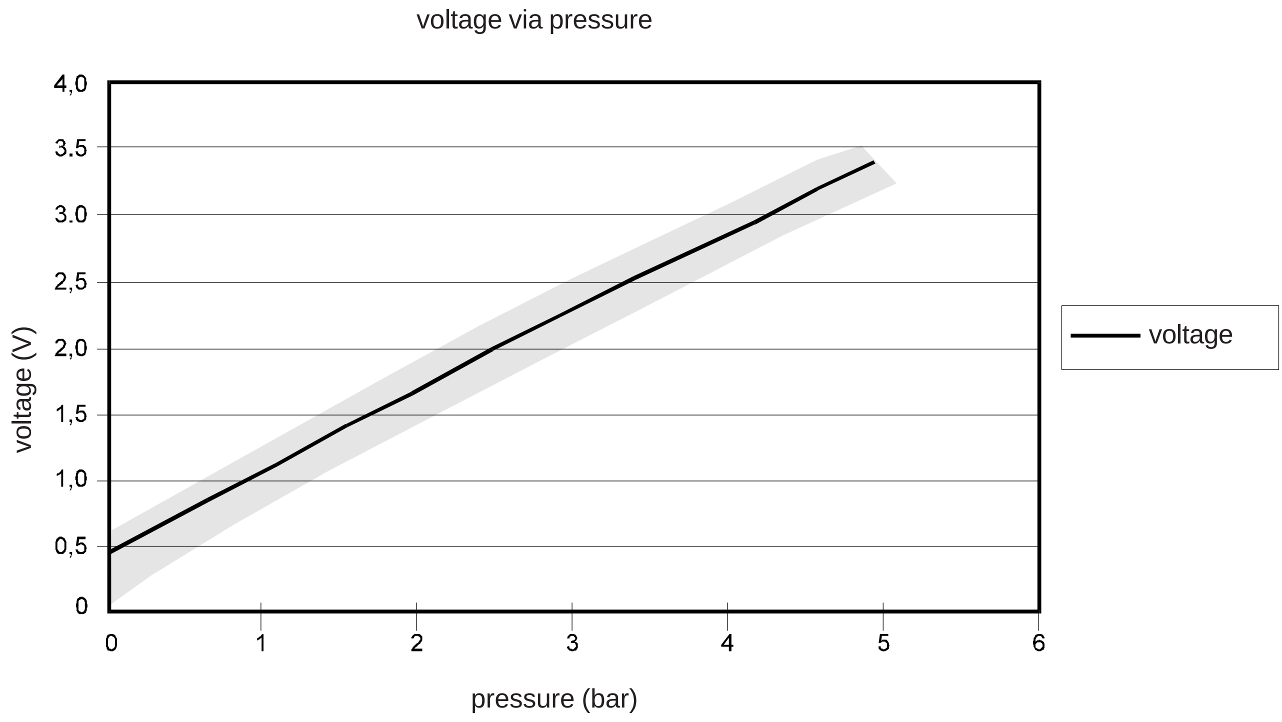
On account of the sensor's integrated electronic system,only the supply voltage and/or the output signal can be measured.
Make sure that with disconnected plug X15 and ignition "ON" the error code 32 HiLPS is stored
--> At completion of check, cancel the error code; refer to 06.06.04

Use a standard voltmeter / multimeter to mesure the supply voltage and/or the resistance.

Supply voltage + 5V +/- 0,4V
ignition ON main relay K27 active
measuring point GND on X18/A against + 5V on X18/B

Continuity from X18/C to control unit X5/10
max. resistance 2 ohms

Output signal depending on pressure; see diagram
Remove B18 and admit pressure when X18 is connected; **max. 5 bars**
measuring point X18/C --> X18/B



10.05 ill.11

06.10.05.06 Check oil pressure sensor "VDO-instrument" (option B19)

NOTE: If oil pressure is questionable,
- check oil level before starting the engine.
- check minimum oil pressure.

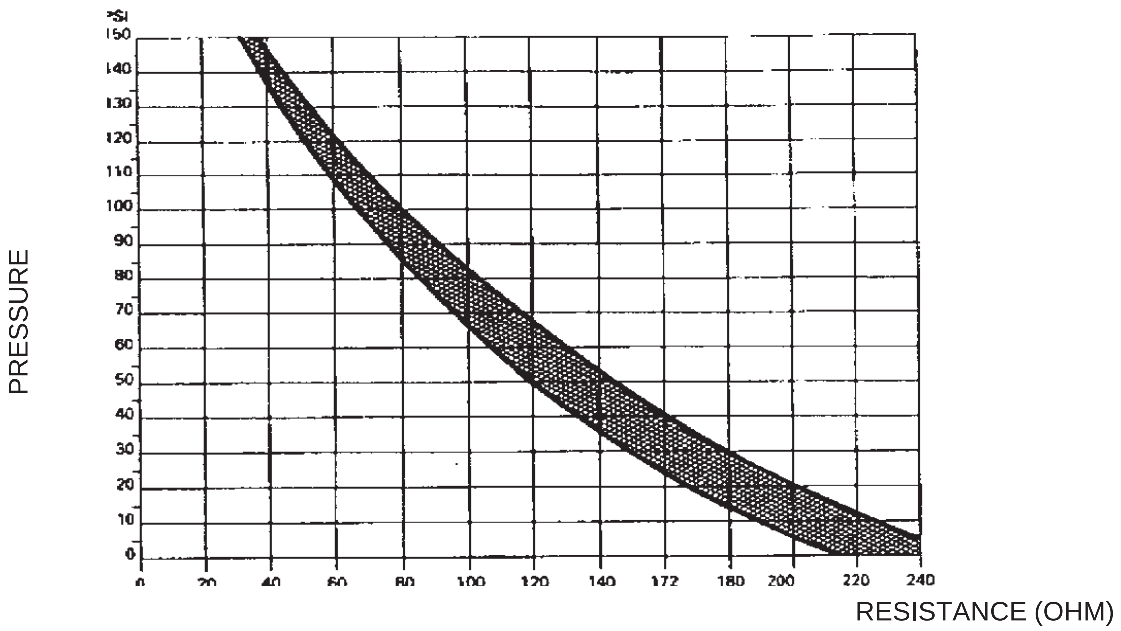
Minimum oil pressure

Idle	1 bar
1000	2 bar
2500 and above	4 bar

Check minimum oil pressure:
Start engine and let engine run at idle speed, 1000 and 2500 r.p.m. Check tachometer and and oil pressure gauge. Record oil pressure value for idle speed, 1000 and 2500 r.p.m. If values are not appropriate, check the oil pressure gauge before checking the oil pressure sensor. To check the oil pressure gauge, disconnect cable from sensor, turn on ignition key and shortly put the sensor cable to ground connection. If gauge functions properly, the pointer will shortly deflect to high values. If there is no malfunction of the gauge, replace the oil pressure sensor.

Check of oil pressure sensor:

1. To check the oil pressure sensor, disconnect the sensor cable and connect an ohmmeter to sensor terminal and sensor.
2. Check resistance at zero pressure; resistance should be 240 Ohm ± 10 %.
   - If resistance is out of tolerance limits, replace the oil pressure sensor.
   - If resistance is within the tolerance range but function of oil pressure sensor is still questionable, measure the resistance over the entire field.



10.05 ill.12

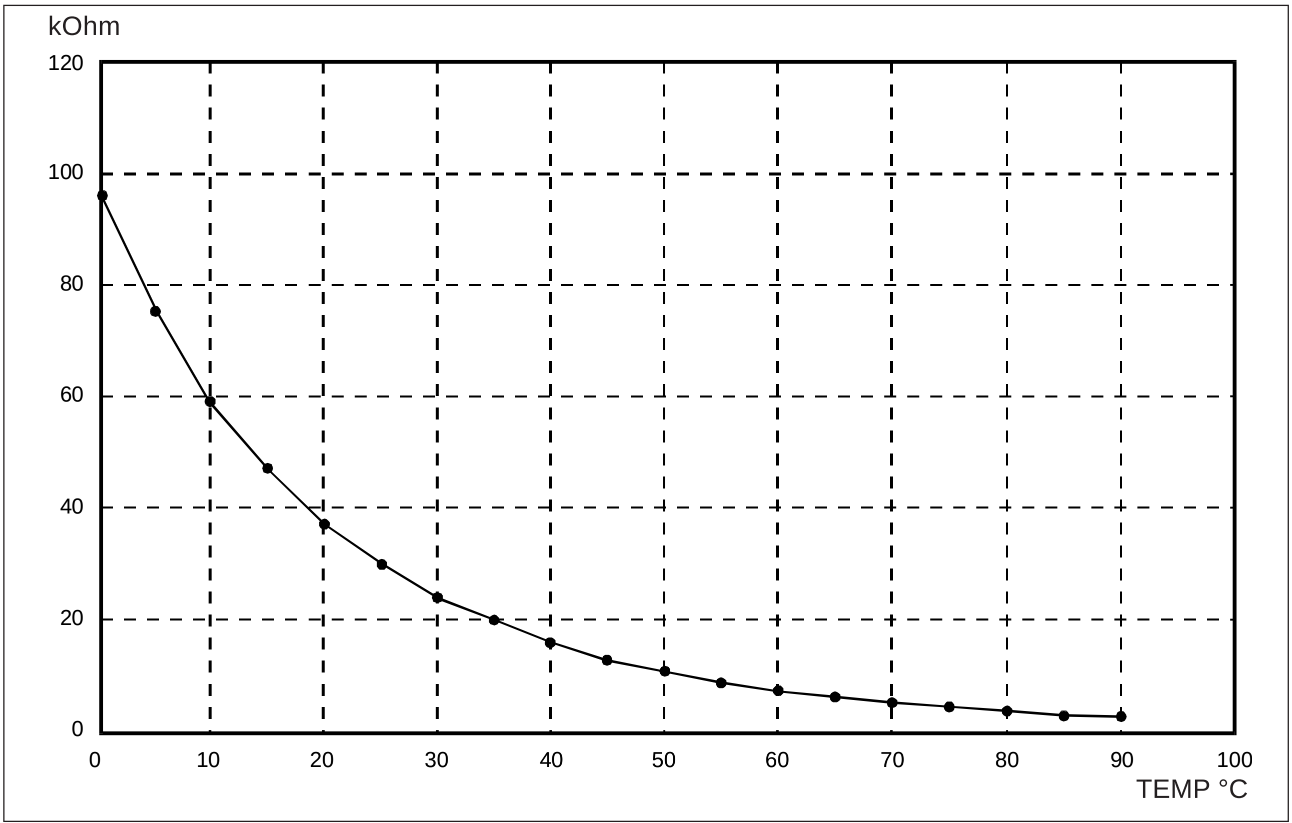
Check oil pressure sensor over entire pressure range:

1. Disassemble sensor and connect it to a gauged pressure source.
2. Connect ohmmeter and pressurize sensor. Read and record pressure and resistance at different spots over the entire pressure range.
3. Compare pressure and resistance values with chart. If values are not within tolerance range at one spot, replace sensor.

06.10.05.07 Check coolant temperature sensor, B16

To check the coolant temperature sensor, make the following test with connected ohmmeter. In case of failure, replace the sender.

1. Compare resistance value and ambient temperature to curve of diagram. Range of tolerance is ± 10 %.



10.05 ill.13

2. If this check brings no information, drain the coolant and remove the sensor. Immerse sensor together with thermometer into a canister with coolant. Connect a digital ohmmeter to the sensor and heat the fluid on a heater. Monitor ohmmeter und thermometer. The ohmmeter should show values corresponding to the values of the resistance curve with a tolerance range of ± 10%.

06.10.05.08 Check audible warner

0,7 sec. with ignition "ON" ==> function check and message "no error stored"

06.12. BATTERY

06.12.01 Battery

Battery - Acid Test

The battery provides the starter engine with energy and supplies the required voltage for lighting and other electrical equipment when the engine is not running. During the starting procedure and when the generator does not generate any current, the battery provides the electronic engine management system with voltage.

For 4 cyl. engines only
Use a 12 V battery with a cold test circuit of 450 ampere at -18°C and a capacity of 92 Ah at 27°C, to guarantee the supply of the electric and electronic components for all operating conditions.

For 24 V - installation only
Use two 12V batteries with a cold test circuit of 650 ampere each at -18°C and a capacity of 115 Ah at 27°C, to guarantee the supply of the electric and electronic components for all operating conditions. The batteries are connected in series and provide a capacity of 115 Ah / 24 V for the external supply of all electric components on the boat.
12V supply of all electric and electronic components on the engine (including instrument panel) by center tapping. Additional charge is guaranteed by charging equalization.

For 6 cyl. engines only
Use a 12 V battery with a cold test circuit of 650 ampere at -18°C and a capacity of 115 Ah at 27°C, to guarantee the supply of the electric and electronic components.

Explanation:

Cold current test: The cold current test is a specified load test of a battery.The charge of battery with specified current **(e.g. 450A)**.
After discharge for 30 sec., the voltage should not drop bellow ^{3}**9V**.

Capacity: With a current consumption of $^1/_{20}$ of specified capacity **(e.g. 92Ah)** the battery voltage must not fall below 10 V after 20 hours, to guarantee the engine's starting ability.

Maintenance

To guarantee long battery life, the following tests should be carried out periodically.

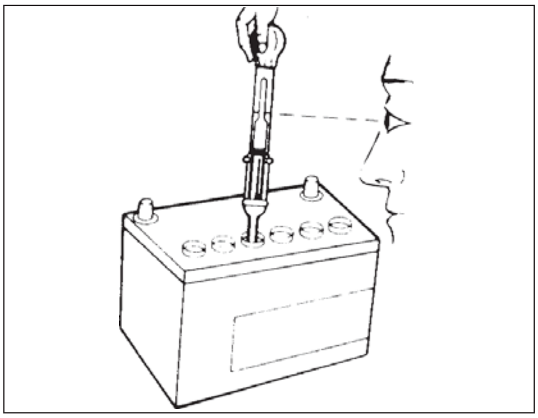
1 The level of battery acid must always be above plates and separators. The acid level should reach the marking on the battery. Acid may only be refilled by an expert when it was definitely stated that some of it has been spilled.

ATTENTION: Battery fluid is an aggressive acid and must be handled with care. In case of skin contact rinse thoroughly with water and consult a doctor - physician.

2 The battery should always be charged as full as possible. Regularly check the state of charge with the battery acid tester. We recommend to check the acid density and acid level periodically every two weeks. If the density is 0.04 kg/dm³ below the value of full charge, the battery is to be removed and re-charged.

DENSITY WITH FULL CHARGE: 1.260 kg/dm³ (at 27°C).

ATTENTION: Never charge the battery on the boat. The vapors resulting from charging could cause an explosion!



12.01 ill.1

For a periodical check of the battery, the following items are to be considered:

1 Protect the boat against acid leakage.

2 Clean battery.

3 Check connections and cables.

4 Clean battery contacts. (neg./pos.)

5 Check holding device of battery.

6 Check housing for damages (acid leakage).

7 Check acid density.

8 Disassemble battery for test. In case of less than 3/4 charge, charge it by means of battery charger, carry out charge test.

9 Check acid level.
In case of a bad state of charge or excessive loss of water, check charge circuit.
Clean battery, contacts and terminals with a solution of soda and water. This neutralizes the battery acid. After cleaning with the solution, rinse the surface with water by taking care that the solution does not penetrate into the battery

ATTENTION: When connecting the battery cables, take special care of correct polarity. Incorrect polarity destroys electronic components.